Matias Pihlajamaa

Assessing the negative impacts of unconventional monetary policies: Zombie companies in the Finnish economy

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VAASAN YLIOPISTO
School of Accounting and Finance
Author: Matias Pihlajamaa
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ABSTRACT:

Euro-area inflation has not been able to reach the targeted sub-two percentage level which has led to the implementation of a wide range of monetary tools and policies. Conventional tools, to which this paper refers to as tools that are included in the original mandate of the European Central bank (henceforth ECB), have not had the desired impact on the economy and the euro-area inflation.

The new tools, such as forward guidance, quantitative easing, and negative interest rate policies have affected positively the economy, but albeit the growing volume of the new measures the inflation level has not reached the ECB's target level. At the same time, the unconventional policies have gained increasing criticism due to their negative side-effects. Most notably, the critics have claimed that the policies jeopardize financial stability and create a moral hazard because negative interest rates have forced the financial institutions to seek yields from riskier asset classes. Furthermore, the increasing liquidity in the economy has raised concerns about the growing number of zombie companies that have not exited the market due to the low-interest rate levels and market inefficiencies. Global results present that zombie companies lower the overall efficiency by building bottlenecks by inefficient capital allocation and hinder new market entries and innovations. The purpose of this thesis is to estimate the number of zombie companies in the Finnish economy utilizing listed company data and scrutinize the negative impact of said companies. The most significant contribution of this paper is the broad estimates of zombie companies in the Finnish economy with methods that are for not better knowledge utilized in the Finnish data sample before.

Broad zombie company estimates in line with previous academia utilizing listed company data from the Finnish economy provide insight into the phenomena in the Finnish economy. Estimates define 11-28 companies to be zombies from the data sample. The results present that in particular, in the mining and computer- and software service industries the number of zombie companies is more prominent than in others. The results also indicate that the financial industry is not well suited for these kinds of estimates due to the reason that the character of the industry is large debt ratios.

KEYWORDS: Monetary policies, economics, zombie companies, nirp, inflation

VAASAN YLIOPISTO
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TIIVISTELMÄ:

Euroopan keskuspankki (EKP) ei ole kyennyt saavuttamaan tavoiteltua liki kahden prosenttiyksikön vuosittaista inflaatiotavoitetta monipuolisesta rahoituspolitiikan käytöstä huolimatta. Tämä tutkimus viittaa tavanomaisina työkaluina EKP:n alkuperäisen mandaatin määrittelemiin rahapoliittisiin työkaluihin, joista ei ole ollut toivottua vaikutusta talouteen tai euroalueen inflaatioon.

Rahapolitiikan epätavanomaiset työkalut ja operaatioiden kasvavat suuruusluokat ovat vaikuttaneet euroalueen talouteen positiivisesti, mutta inflaatiotavoitteeseen ei olla näistä toimista huolimatta päästy. Uusia työkaluja ovat ennakoiva viestintä rahapolitiikan vaikutuksista, määrällinen kevennys, sekä negatiivinen korkopolitiikka. Kriitikot väittävät epätavanomaisen rahapolitiikan vaarantavan talouden tasapainon luomalla moraalikatoa, jonka seurauksena rahoitusinstituutiot pakotetaan hakemaan tuottoa enemmän riskejä sisältävistä omaisuusluokista. Lisäksi talouden kasvanut likviditeetti on nostanut huolia zombiyritysten kasvavasta määrästä, jotka eivät ole poistuneet markkinoilta alhaisen korkoympäristön ja markkinoiden toimimattomuuden johdosta. Kansainväliset tutkimukset osoittavat, että zombiyritykset laskevat kansantalouden kokonaistuottavuutta luomalla pullonkauloja uusille toimijoille ja näin vähentäen innovaatiotoimintaa. Tämän tutkimuksen tavoitteena on estimoida zombiyritysten lukumäärää Suomessa hyödyntämällä listattujen yritysten dataa ja arvioimalla näiden yritysten haitallisia vaikutuksia taloudessa. Tämän tutkimuksen tärkeimpänä kontribuutiona ovat laajat zombiyritysten lukumäärää estimoivat estimaatit, joita ei ole paremman tietämyksen valossa aikaisemmin hyödynnetty suomalaisessa data-aineistossa.

Laajat estimaatit, jotka ovat linjassa kansainvälisten empiiristen tutkimusten kanssa antavat osviittaa zombiyritysten lukumäärästä Suomessa. Estimaatit osoittavat, että 11-28 yritystä voidaan määritellä zombeiksi käytetyn datan nojalla. Saadut tulokset viittaavat siihen, että erityisesti kaivosteollisuus ja tietokone- ja ohjelmistojenhuoltotoimiala ovat haavoittuvaisia zombiyrityksille käytettyjen estimaattien perusteella. Tämän lisäksi tulokset näyttävät, että rahoitustoimiala ei sovellu käytettyihin estimaatteihin, koska korkea velkaantuneisuusaste kuuluu toimialan erikoispiirteisiin.

AVAINSANAT: Rahapolitiikka, taloustiede, zombiyritys, nirp, inflaatio

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1 Introduction

After the global financial crisis and the following European debt crisis, the euro area harmonized index for consumer prices (henceforth HICP), which is used to measure the annual inflation, has had difficulties to reach the target level. European Central Banks (henceforth ECB) target level for annual inflation is close, but below 2% change in the HICP. To address this problem the ECB has implemented a wide range of both conventional- and unconventional monetary policies aiming to boost up the economy through increasing the euro area liquidity and hence the inflation. However, albeit the unprecedented measurements, the HICP has not reached the desired target level and the criticism towards the negative side effects of the unconventional policies has been gaining attention. Critics claim that the unconventional policies and in particular the negative interest rate policies (henceforth NIRP) are built on a flawed pre-Keynesian theory that by manipulating the interest rate levels full employment can be obtained. Moreover, the NIRP has been argued to cause severe risk towards financial institutions' financial stability by encouraging investing in riskier asset classes to obtain the desired yield. Albeit the severe negative impacts on financial stability, arguably the most severe criticism which NIRP has gained is that the policies have increased the number of zombie companies in the economy. According to the Schumpeterian growth theory, the companies which are no longer efficient should go out of business and by doing that, the overall efficiency should grow. The increasing number of inefficient companies that are due to the loose monetary policies have reduced the euro area productivity. The main object of this thesis is to try to estimate the presence of zombie companies in the Finnish economy utilizing listed company data with methods which for better knowledge has not been utilized before.

The thesis starts by taking a comprehensive look at the conventional monetary policies to obtain a better understanding of why the central bankers decided to introduce new, unconventional policies before diving into the negative side-effects.

After scrutinizing both conventional- and unconventional measures and their impact on the economy this paper will examine the negative side-effect of zombie companies. Finally, broad estimates in line with previous academia are implemented to a Finnish dataset to estimate the presence of zombie companies in the Finnish economy.

2 Aim and task of the Central banks

To better understand why monetary policies are crucial to financial stability and therefore economic growth, it is important to understand the role of the central banks in the modern economic environment. In the next chapter, this paper will take a closer look at the theoretical background of central banks and the sub two percentage inflation targets before scrutinizing monetary policies.

2.1 Theory of financial stability

Central banks play a crucial part in the modern economy functions as the supervisor for the economy and looking after dangerous fluctuations. Over time CBs have had their advocates and their critics, such as the Austrian school of economics, but despite the viewpoint, many agree that they are a crucial part of a well-functioning economy. After the Second World War Europe was on its knees and the world economy was severely damaged. There were concerns that the European economy would drift into hyperinflation, a situation where the prices of goods and services would skyrocket and ultimately destroying the value of national currencies. Hyperinflation had occurred in Germany after the first world war causing damage to the lives of ordinary people and hence it was on everyone's focus to prevent it from happening again. John Maynard Keynes argues in his book already in 1924 of the harmful impacts of inflation: "*As the inflation proceeds and the real value of currency fluctuates … foundation of capitalism become so utterly disorder as to be almost meaningless …" (2017, p.220).* As an answer to the postwar demand for financial stability, with the lead of the United States and Great Britain, the Bretton Woods conference was summoned.

The aim for the Bretton Woods confers was to tie the USD to a gold standard and other currencies to USD, creating a fixed exchange rate system and provide financial stability.

Bordo (1993, p.28-35) argues that three perceptions were used as the foundation of the birth of the Bretton Woods system: stable exchange rates, national full-employment, and cooperation. However, the different interwar experiences lead to asymmetries between the members, and the misperception of these fundamental building blocks later led to the fall of the Bretton Woods system. Furthermore, in his article Bordo (1993) pinpoints three problems of the Bretton Woods system: the adjustment problem, the interwar liquidity problem, and the interwar confident problem.

The adjustment problem was due to the difference between surplus and deficit members, policies did not have the same effect on all the countries, possibly hurting them and causing deflationary biases. These differences between member nations ultimately led to situations where all members did not follow the rules of the conference. (1993, p.28) Member countries had for long devaluated their currencies to obtain a comparative advantage over their neighbors, which was according to the agreement forbidden. The second aspect Bordo (1993) lifts were the interwar liquidity problem: stronger nations and currencies, such as Great Britain, drew bigger gold reserves, causing liquidity problems in other nations. Some of the members could not finance their investments due to liquidity problems, which affected their economic growth. The third aspect Bordo (1993) argues to be a cause behind the structural problems of the Bretton Woods was the interwar confidence problem. Later on, the Bretton Woods system nations and started to shift gold and reserves from weaker nations to stronger, causing confident issues regarding the liquidity of the weaker hub. In the beginning, the movement of reserves was between New York and London, but as the confidence problems grew, also Paris started to attract movement. Hubs that weren't regarded as stable as some of the others started to lose capital leading to unbalance in the reserves. Naturally, this phenomenon caused a lot of criticism eventually reflecting as a lack of confidence in the member countries and to the system as a whole.

Despite the fall of the Bretton Woods system, the demand for financial stability did not vanish. In the aftermath of abandoning the fixed exchange rates and moving the floating exchange rate system, nations drifted to two-digit annual inflation levels. Nations quickly implemented policies to fight against to rocketing inflation numbers and in particular, Paul Volcker, then-Federal Reserve (henceforth FED) chairman, waged war on inflation which is portrayed as the annual change in the consumer price index (CPI)

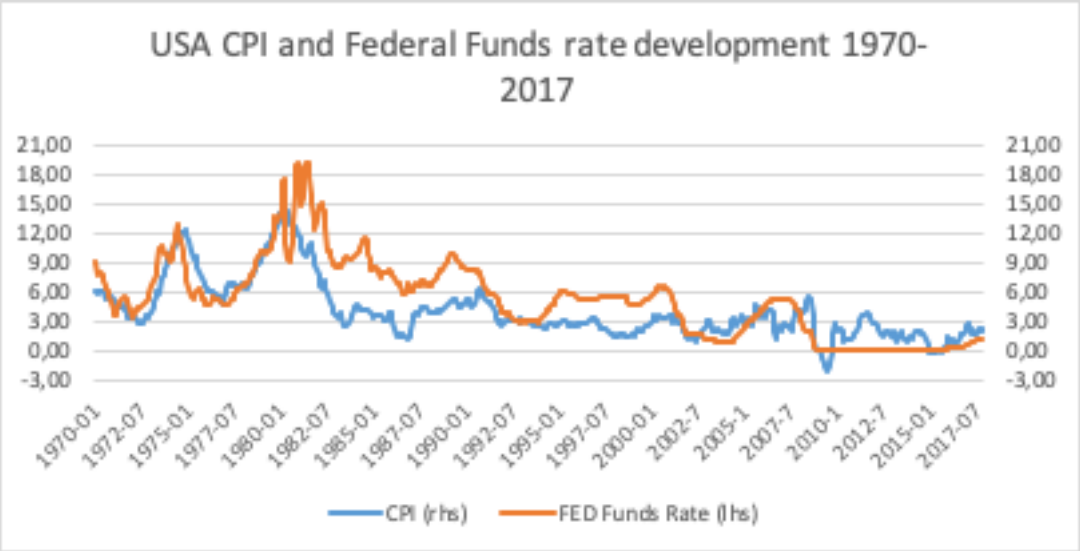

Figure 1 United States CPI and Fed Funds Rate development 1971 - 2017 (OECD & FRED 2019)

Taking the United States as an example[1] for analyzing national policies, we can see from the Chart 1., monetary policies implemented by the FED were successful, but they had their critics: due to the rapid increases in the FED funds rate, unemployment rose rapidly, and GDP deficit grew significantly. However, it is important to acknowledge, that the abnormally high inflation levels forced the central banks to take stronger actions and after the Volcker era the inflation volatility has been steadily declining to improve economic stability. (Judd & Rudebusch, 1998) The theoretical background for financial stability and modest inflation was argued already in the 1960s' by Milton Friedman (1995), demonstrating how a steady monetary target could substantially benefit the economy, by providing a stable environment to the economy.

[1] Data retrieved from the official statistics of FRED and OECD

Further, Akerlof et al. (1996) in their article, showing how too-low inflation targets will lead to significant inefficiencies in the job markets and causing the unemployment rate to be too high. In particular, individuals and companies start to postpone private consumption and investments while waiting for the prices to be lower. In the long run, this is detrimental for the economy, because the economic activity will stop while consumers wait for the better deal, hence why modest inflation is seen to be more desirable than deflation (Akerlof et al., 1996).

Deflation is fundamentally due to monetary policy decisions (Cargill, 2001) and Japan was one of the nations that have suffered from it for a remarkably long time. Japan's economy drifted into stagnation and later deflation after the burst of the asset bubble at the beginning of the 1990s' and has not drifted back to the normal, modest inflation-based growth path. Due to the stagnated growth, the era is commonly known as the "Lost Decade", portraying the poor development of the former Asian powerhouse. (Hayashi & Prescott, 2002) This paper will take a closer look at the Japanese economy later for the reason that Japan was one of the first nations where the phenomena of zombification and zombie companies were presented. During the years there have been many attempts to explain why this has occurred in Japan (Krugman, Domingues & Rogoff, 1998; Meltzer, 2018; Vithessonthi, 2016), but a final answer is yet to be seen. Furthermore, the aging population throws a shadow on the problem and an easy answer is unlikely.

2.2 Inflation within the euro area

Acknowledging the issues regarding deflation and high inflation levels, central banks have implemented inflation targets to their toolboxes. Issing (2004, p.6) defines inflation target as *"… a monetary policy framework that accords overriding importance to the maintenance of financial stability…".* Barro (1995, p. 18-19) presents that the theoretical background for sound monetary policies is in the negative effects on the economy caused by excessive inflation.

A stable environment is more efficient and gives better incentives for economic activities compared to an unstable, unpredictable environment and the negative correlation between the inflation rates and output growth can be seen from the aggregated demand equation (2).

$$\pi = \pi^* - \frac{(1+\eta b)}{\eta h}(lnY - ln\bar{Y}) + z \quad (1)$$

The first region which officially implemented inflation targets was New Zealand in 1990 which was quickly followed by Canada in 1991, the United Kingdom in 1992, and Sweden in 1993. Mishkin (1999) argues that regimes that had implemented inflation targets were more successful to curtail the inflation levels and maintaining it down, compared to regimes where similar policies were not implemented. Furthermore, Mishkin (1999) discovers that nations that had implemented inflation targets were more resilient towards inflationary shocks occurring from events such as negative production shocks. This is also one of the key arguments by Issing (2004) where he scrutinizes the performance of ECB and its inflation targets within the euro area. It is important to acknowledge, that the reason why inflation targets have been more effective than interest rate targets, is due to its more liberal definition: central banks have more freedom, i.e. more flexibility to choose the policies when targeting inflation compared to a situation where the interest rate would be under scrutiny.

However, despite the benefits of inflation targets, Neumann and Von Hagen (2002) warns that regimes should not adopt inflation targets that are too strict. Regimes should implement symmetrical inflation targets, that would allow more flexibility, a thing that has been raised numerous times when scrutinizing European Central Banks (non-symmetric inflation target. The benefits of flexible inflation targets were later proved by Cornand and M'baye (2018) showing in their research how regimes should always adopt a flexible inflation target compared to a fixed one.

They present, that inflation was significantly lower in regimes where strict inflation targets were used, but the inflation volatility did not differ as much when comparing flexible and strict inflation target nations. It is important to acknowledge, that one system is not automatically better than the other; as in many cases if a central bank should adopt strict or flexible inflation targets depends greatly on its objects and other stability indicators and the surrounding world. (Cornand & M'baye, 2018; Issing, 2004)

Despite the common target, there are some differences between different central banks' inflation targets and measurement methods. By scrutinizing table 1. It can quickly be seen the similarities and differences of inflation targets and definitions of the ECB in the euro area, FED in the United States, and lastly Riksbanken in Sweden. The goal of price stability in the ECB was set by the Maastricht Treaty, formally known as the Treaty on European Union, in 1992 which later was quantified as below, but close to 2 percentage levels measured by a year-on-year increase of the harmonized index of consumer prices (HICP). Comparing to the other economic areas portrayed in table 1., the ECB is responsible for 19 nations, which all have different economic performance, population, and challenges. Hence this unique aspect, ECB cannot rely on the simple Consumer Price Index (CPI) while measuring inflation in the euro area, needing to utilize the Harmonized Index of Consumer Prices (HICP) instead.

Table 1 Central Bank Inflation targeting (ECB, 2019; FED, 2019; Riksbanken, 2019).

Central Bank	**Target Definition**	**Target Level (percentage for annual inflation)**	**Time Horizon**
ECB	Price stability is defined as a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) for the euro area	Below, but close to 2%	Yearly
FED	Measured by the annual change in the price index for personal consumption expenditures (PCE)	Symmetric 2 %	Yearly
Riksbanken	Inflation is measured by the CPIF index	Symmetric 2 %	Yearly

Due to the differences between member nations, the HICP reassures that all the nations use the same methodology and therefore the data is comparable. Like the CPI, HICP consists of a basket of goods and services, which presents the typical expenditures of ordinary citizens. The basket is regularly revised, and some goods and services are excluded or included aiming that it would reflect as truthfully as possible the actual expenditures.

Compared to the FED and Riksbanken it is clear how the inflation target is different from its counterparts: it is the only central bank of the three which uses a non-symmetrical inflation target. During the years, and particularly after the financial crises in 2009, there has been some criticism about whether or not the ECB should also implement symmetrical inflation targets such as many central banks have done. Mario Draghi (European Central Bank Speeches, 2016), the former president of the ECB, address the question in his speech in Vienna 2016 stating that symmetrical inflation targets would not be the answer for the structural problems within the euro area, and the answers should be looked from somewhere else.

The debate whether or not the ECB should implement the symmetrical inflation target to its object is ongoing, and with the newly announced president Christine Lagarde it is unclear, what the future position of the ECB will be.

Compared to many other central banks, the ECB is in a unique situation where it needs to coordinate the monetary policy to a region of 19 different nations. Members, such as Germany and France differ drastically from poorer nations such as Italy and Spain despite, they share the same monetary policy framework and central bank. A wealthy nation such as previously mentioned France and Germany possesses a GDP per capita levels that are up to a third higher compared to Italy and Spain. According to the World Bank data library, Germanys' GDP per capita measured in USD was significantly higher than its counterparts, measuring over 47 000 USD in 2018, while Spain barely broke the 30 000 USD per capita level during the same year. Acknowledging the challenges ECB faces with the different economies, it is important to understand the semantics behind the current inflation target and why it is set at the current level.

The sub-two percentage inflation target was for the first time lifted by the ECBs Government Councils meeting in 1998 where the president of ECB, Dr. Willem F. Duisenberg, stated in his speech that inflation target should be measured as *"…price stability shall be defined as a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) for the euro area of below 2%"* (European Central Bank Speeches, 1998). Four years later the target was revised to the sub-two percentage level.

The benefits of a quantitative inflation target are transparency, clearance, and forward guidance; it is easier to understand the implemented monetary policies if the object is a real measurable number, compared to an abstract goal. According to the ECB's monetary strategy, a sub two percentage inflation level is a suitable level for three reasons. First, it provides a fair safe margin to implement monetary policies to tackle deflation. Second, it is high enough to give a margin for differences in national inflation levels while making sure, that monetary policies won't cause deflation.

Finally, the index used to measure the inflation within the euro area, HICP, have the tendency to give values that are too high and an inflation target which would be lower, would build a risk for measurement errors and ultimately deflation.

However, the ECB has not been able to reach the desired level and volatility between the national inflation level has been growing significantly. For example, Ciccarelli et al. (2017) present in their research that the lagging inflation levels are due to national factors, and in particular adverse cyclical factors, factors that do not hit symmetrically on all nations. After the great recession, some nations suffered more than others due to the differences in their economies.

Some nations were more reliable on services and some on manufacturing, so when the recession occurred the impact was not equal for all economies. Further, Ciccarelli et al. (2017) explain that the low inflation after 2014 could be to some extent explained by price shocks, which impacted in particular the oil industry leading to significant price drops in crude oil. Figure 2 portrays the differences between the core inflation excluding food, alcohol, energy, and tobacco and inflation where all the product categories are included.

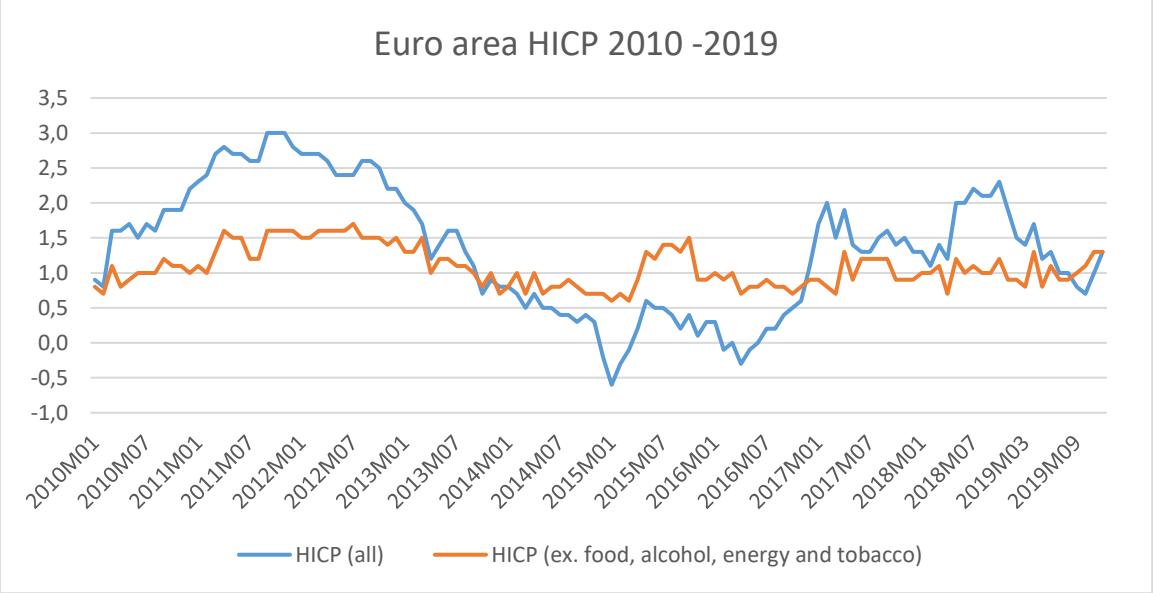

Figure 2 Euro area HICP and core HICP 2010 -2019 (Eurostat, 2020a)

However, the declining inflation levels are a part of a bigger trend that has occurred in the western world for decades which Ciccarelli et al. (2017) argue as well in their article. On the other hand, Bobeica and Sokol (2019) model the euro area inflation through the Phillips curve using a generic model of the formula (5):

$$\pi_t = c + \gamma * \pi_{t-1} + \alpha * \pi_t^e + \beta * x_{t-1} + \gamma * Z_{t-l} + \varepsilon_t \quad (2)$$

Where variable π is the inflation, π_t^e is the expected inflation level, x_{t-1} is economic activity in the region at time $_{t\text{-}1}$ and Z_{t-l} is an external shock variable, with a lag parameter l.

By scrutinizing the lagging inflation levels with the generic Phillips curve model, Bobeica and Sokol (2019) can identify three drivers that could explain the low inflation: external shocks which occurred after the great financial crisis transferred to the economy with a lag (), which affect the inflation levels up to these days. Further, low inflation levels have also affected future inflation expectations by lowering them. When the unusually low inflation environment has been ongoing for a significantly long time, the future expectations for higher values start to diminish. However, Bobeica and Sokol (2019) argue that changes in future expectations are not the main driver for low inflation levels, but the third variable is exogenous variables, which are not driven from any nation in particular. Trade wars, global recession, and megatrends have all had an impact on the euro area economy and inflation. Albeit, Bobeica, and Sokol (2019) conclude that even though the global phenomena can be seen as an answer for the lagging inflation, the empirics supporting the transfer mechanism are unclear, and there is not a single answer for the problem. Despite the dispute regarding the transfer mechanism, Ball and Mazumder (2019) agree that the so-called “missing inflation” can be explained by the Phillips curve.

In line with Bobeica and Sokol (2019), Ball and Mazumder (2019) argue that the low inflation levels are mostly due to exogenous variables, such as shocks in the oil industry, even though they are removed from the core HICP. By taking a look at figure 3 the differences between the core HICP and HICPX can be quickly seen, which excludes food, energy, tobacco, and alcohol.

In particular, the core HICP has been lagging significantly below the sub 2 percentage level. Regardless that the energy segment is removed from the HICP, the changes in the oil prices affect the production costs of goods and services, hence affecting the HICP. Albeit, as an answer to the missing inflation (Bobeica & Sokol, 2019; Ball & Mazumder, 2019; Ciccarelli et al., 2017) ECB has implemented both ordinal, and nonordinal measurements. By scrutinizing the ordinal policies, this paper aims to gain a grasp of why the ECB ultimately was forced to implement unconventional monetary policies, such as negative interest rates, and what kind of negative side-effects said policies have created in the euro area economy before estimating the presence of zombie companies in the Finnish economy.

3 Monetary policies under ordinal times

As presented in the previous chapter the ECB has not been able to reach the targeted inflation level of sub-two percentage, despite wide usage of monetary policy instruments. Taking a look at table 3. the magnitude of implementation of the various instruments ECB has in their toolkit can be quickly seen. In this chapter the aim is to assess the theoretical background and impacts of the so-called ordinal monetary policy tools in ordinal times to understand, why the ECB has been forced to introduce new, non-ordinal instruments that are not listed in their original mandate to reach the targeted inflation level.

As previously mentioned, according to the ECB's strategy the ECB's target is to obtain an annual inflation level of close, but below two percent with the support of three distinct instruments: standing facilities, open market operations, and minimum reserves. Standing facilities refers to the level of interest rate which ECB uses to offer credit to financial institutions, such as commercial banks. Furthermore, open market operations are used to provide additional liquidity to the economy through main refinancing operations (MRO) and long-term refinancing operations (LTRO). The third instrument used to steer the inflation is the minimum reserve requirements, which determines how much collateral financial institutions are mandated to keep in their balance sheets in comparison to the credit they lend.

3.1 Standing facility rates

Before the global financial crisis (GFC interest rates were thought to function according to the new-Keynesian framework: if the economy was heading towards recession, the central bank would lower the interest rates to boost up the consumption and if the economy showed signals of overheating, the rates would be raised.

However, hence the new-Keynesian theory is built on certain assumptions, it has caused problems to the economy (Cúrdia & Woodford, 2009).

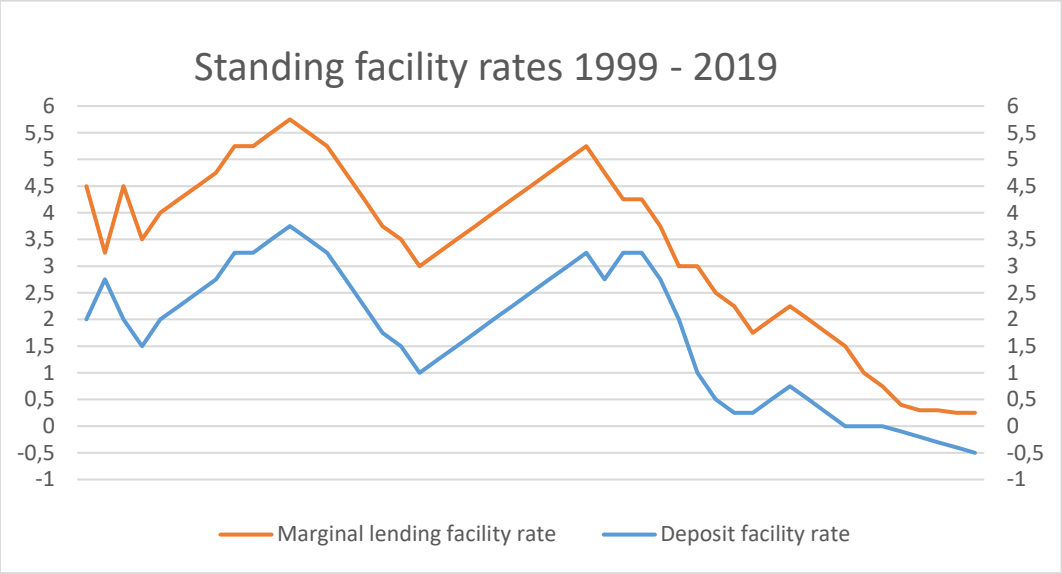

Figure 3 Standing facility rates 1999 - 2019 (Eurostat, 2020b)

Before the recent low-inflation environment central bankers were able to utilize simpler monetary policy models to determine the suitable interest rate level, such as the well-known Taylor rule:

$$i = \pi_t + r + 0.5(\pi_t - \pi^*) + 0.5(y_t) \quad (3)$$

where the parameter i is the interest rate set by the respected central bank, π_t is the observed inflation during the period t, r is the real or natural interest rate, π^* is the targeted inflation level and y_t is the output gap, measured as $\frac{\overline{Y-(Y)}}{\bar{Y}}$. In the original model John Taylor (1993) presents that the weights for inflation and production gap for the United States were estimated as 0.5 and 0.5 respectively, but in the later models, the Taylor rule has been presented as the general form presented below.

$$i = \pi_t + r + \alpha(\pi_t - \pi^*) + \beta(y_t) \quad (4)$$

Albeit creating the formula as a simple tool to demonstrate the rule-like behavior of the central banks, John Taylor discovers that the model was remarkably accurate when predicting Federal Reserve's monetary policy decisions (1993). Later, Judd and Rudebusch (1998) scrutinize the accuracy of the Taylors rule in the United States in the time period of 1970-1997 and notice, that the Taylors rule was able to explain the FEDs reactions remarkably well. However, Judd and Rudebusch (1998) present that different FED chairmen, Arthur Burns, Paul Volcker, and Alan Greenspan, had very different focus points when tackling the inflation- and production gap, hence the divergence from the Taylors rule outcomes. They further argue that the different characteristics could explain why the FED had chosen a hawkish or dovish stance to tackle inflation.

Albeit the relatively good explanatory power in the United States, when trying to implement the Taylors rule to euro area data by ECB, the results have not been as clear. Gorter, Jacobs and De Haan (2008) argue that even though Taylors rule can be used to some extent to predict the optimal interest rate level, there are more sophisticated models that take future expectations into consideration and hence be more efficient. Gorter et al. (2008) further explain that the reason why ECB seems to follow the Taylors rule to some extent is due to the lack of a forward-looking perspective, which is utterly vital to achieving financial stability within the euro area.

By scrutinizing the deposit facility- and marginal lending rate side by side a phenomenon is known as the "Facility rate corridor" occurs. Standing facility rates set the ceiling and the floor for the demand of central bank stimulus, where the deposit facility rate acts as the floor and the marginal lending rate as the roof (Bindseil & Jablecki, 2011a). Bindseil and Jablecki (2011a) present how the development of the facility corridor affects the euro area economy.

As seen from Figure 3. and table 2. the corridor has historically stayed around 200 basis points during good economic times and retreated during recessions, such as after the 2008s financial- and euro area crisis. However, when expanding the horizon to other central banks, the width of the corridors can vary anywhere from 75 basis points all the way to 875 basis points (Bindseil & Jablecki, 2011b).

Bindseil and Jablecki (2011a) argue, that if the corridor is relatively small, it will have a negative impact on the magnitude of central bank intermediation and the interbank lending but lower the corporate clients' interest rates. Bindseil and Jablecki (2011b) further presents how the optimal corridor width depends of the central banks' utility function (8.):

$$U = \frac{t^{\alpha}}{\sigma_i^{\beta} l^{\gamma}} \tag{5}$$

The parameter U presents the central bank utility, t is the magnitude of interbank trading, σ_i is volatility, l is the cost of the central bank intermediation and parameters α, β, γ are constant that obtain values < 1. They demonstrate that depending on if the central banks possess an a) neutral, b) market-promoting or c) volatility averse utility function, the corridor can move as much as 25 basis points depending on the type of the central bank. More market-promoting central banks have naturally the widest corridor, with 175 basis points to allow more freedom while the risk-averse central banks favor corridors 25 basis points narrower. (Bindseil & Jablecki, 2011b)

Table 2 ECB facility rate corridor 2008-2019 (Eurostat, 2020b).

Date of change	Corridor width (Basis points)
8.10.2008	200
9.10.2008	100
21.1.2009	200
13.5.2009	150
8.5.2013	100
13.11.2013	75
11.6.2014	50
9.12.2015	60
16.3.2016	65
18.9.2019	75

Table 2. demonstrates what figure 3. presents graphically and the ongoing trend of the 2010s can be quickly seen; the corridor has narrowed by 125 basis points since November 2008. As Bindseil and Jablecki (2011a) present, the narrowing corridor allows the central banks to obtain more control of the market, but simultaneously creating side effects to the interbank lending. Hence the drastic change in the corridor width, it is justified to ask whether or not the corridor could be set to zero. By doing that the central banks would obtain even more control of the market, which Berentsen, Marchesiani and Waller (2010) scrutinize in their research. They introduce two possible scenarios: one where the central bank is able to function without tax frictions and one where tax frictions are implemented. If the tax frictions are not implemented and not causing any distortion to the supply or demand, it is argued to set the deposit facility rate equal to the lending rate so that the corridor is zero. (Berentsen et al., 2010)

The motivation behind this policy suggestion is that without any tax friction to hold money is costless while still following the Friedman rule[2], which Berentsen et al. (2010, p.17) described as following: "… *such a policy means that the money market rate and the central bank's deposit rate exactly compensate market participants for their impatience and for inflation.".*

However, if the model is expanded to include tax frictions the optimal corridor is no longer zero, but a slightly positive value where the deposit facility rate is set just below the lending facility rate. Albeit, it is important to understand that due to political decisions tax frictions do affect the transfer mechanism, and hence the zero-corridor is difficult to obtain, which also Bindseil and Jablecki (2011a) conclude.

3.2 Open market operations

Parallel with the standing facility rates ECB has for long utilized open market operations to achieve financial stability within the euro area. The fundamental idea behind the open market operations (henceforth OMO) is seeking to add liquidity to the market through bond-buying programs. The operations can be divided into four different categories: main refinancing operations (MRO), long-term refinancing operations (LTRO), fine-tuning operations (FTO), and structural operations. Further, the operations differ in the length of their respected maturities where MROs typically have a maturity up to one week compared to LTROs which can range to three months and FTOs which are conducted on daily bases (Eisenschmidt, Hirsch & Linzert, 2009).

[2] If the central bank is able to produce fiat money, the cost of holding currency should be set to zero.

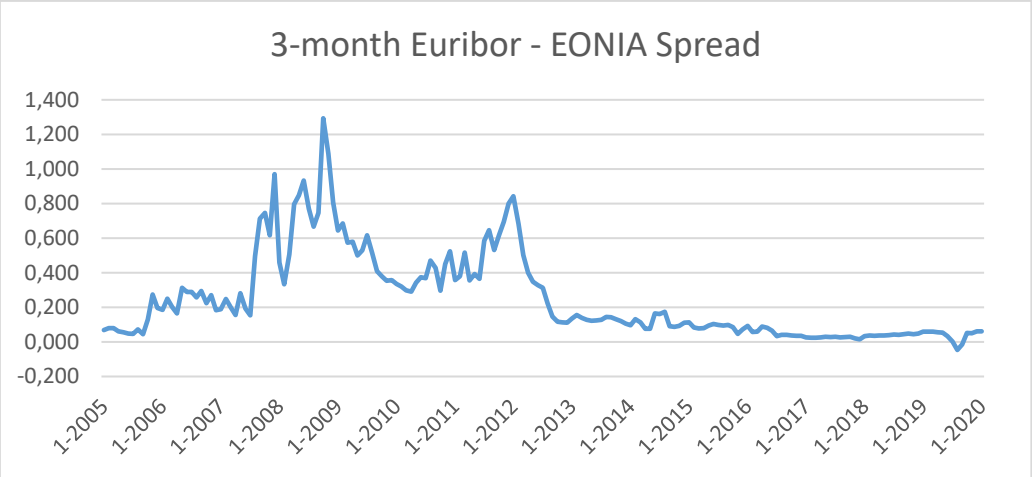

Figure 4 3-month Euribor - EONIA spread (Eurostat, 2020c; Eurostat 2020d)

Before the financial crisis and the introduction of nonordinal monetary policies, the ECBs OMOs had been quite successful to obtain its goal without causing significant market distortions (Ejerskov, Moss & Stracca, 2003). In particular, according to the research by Ejerskov, et al. (2003) the conducted OMOs in the early years of the monetary union were able to provide additional liquidity smoothly, without causing abnormal market movements or significant deviations. Parallel with the findings by Ejerskov et al. (2003), Linzert, Nautz and Bindseil (2004) discovers when scrutinizing the market impacts of LTROs, the results of respected research were in line. As well as Ejerskov et al. (2003), Linzert et al. (2004) focus in their article on the first five years of the monetary union and presents that ¼ of the banking sector repo credit is due to the LTROs.

Moreover, despite the magnitude of the pre-crisis operations the operations were in practice neutral and caused very little distortions to the markets (2004). Noteworthy is the magnitude of the growth of OMOs during the existence of the respected policies. For instance, the MROs first introduced in 1999, has grown exponentially from the first allotted packages. Taking a look at figure 5. the growth developed already in the early years of the policy rapidly and gained more speed after the global financial crisis in 2008.

Taylor and Williams (2009) presents that the spread growth between overnight indexes, such as EONIA[3], and long-term rates can be used to explain the increasing volume of OMOs. The spread between rates that are considered risk-free, such as over-night rates, and longer-term rates are used to measure the intermediate-risk between banks. Figure 4. shows the spread between the 3-month Euribor rate and monthly EONIA rate, calculated as the monthly average from daily observations, reveals why the MROs experienced a significant growth spur during the global financial crisis.

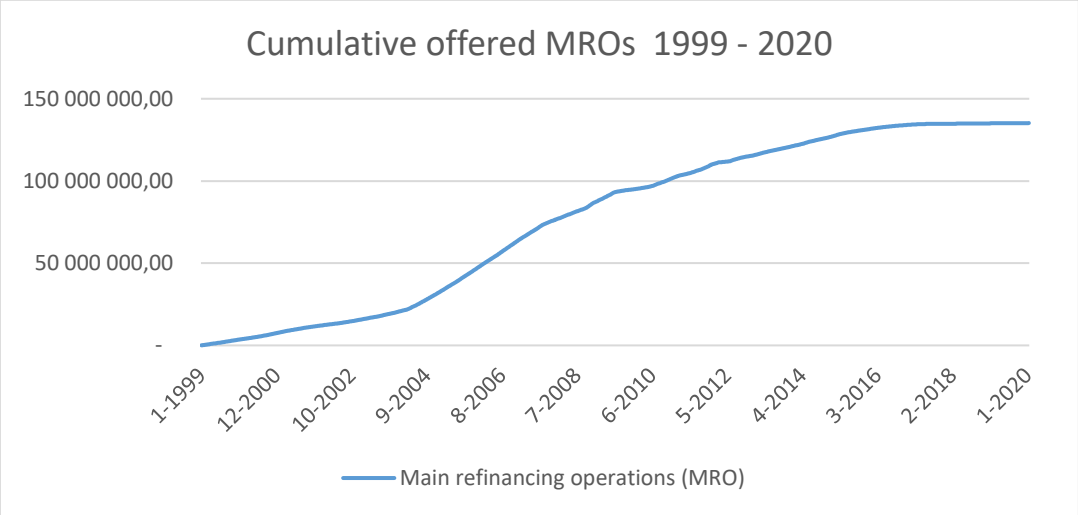

Figure 5 Cumulative MROs 1999 - 2020 (ECB, 2020a)

Albeit the OMOs magnitude and lowering interest rate environment the ECB has not been able to reach the inflation goal of sub 2%, which can be seen from figure 2. To tackle the ongoing low-inflation regime ECB has introduced an array of so-called nonordinal monetary policies, which are policies that are not defined in the original mandate. This paper will in the next chapter scrutinize the policies before analyzing the main objective of this thesis: have the new nonordinal policies caused more harm than good, and have they impacted to the presence of the zombie companies within the euro area economy.

[3] Since October 2, 2019 Euro Interbank Offered Rate (EONIA) is gradually replaced by the euro short-term rate (€STR)

Table 3 ECB Governing Council decisions 2009 - 2020 (ECB, 2020b).

Date	Policy type	Summary
15.1.2009	Main Interest rate cuts	Main refinancing operations rate lowered by 50 basis points to 2.0%, marginal lending rate to 3.0% and deposit facility rate to 1.0%
5.3.2009	Main Interest rate cuts and long-term refinancing operations	Main refinancing operations rate lowered by 50 basis points to 1.5%, marginal lending rate to 2.5% and deposit facility rate to 0.5%. Furthermore, long-term refinansing operation launch.
4.2.2009	Main Interest rate cuts	Main refinancing operations rate lowered by 25 basis points to 1.25%, marginal lending rate to 2.25% and deposit facility rate to 0.25%
7.5.2009	Main Interest rate cuts and long-term refinancing operations	Main refinancing operations rate lowered by 25 basis points to 1.0%, marginal lending rate to 0.75% and deposit facility rate kept in 0.25%. Further long-term refinancing operations are implemented
4.6.2009	Bond buying program	Purchasing euro-demonited cover bonds (CB) which are issued in the euro area
10.5.2010	Securities market programme	Launch of the Securities market programme and adoptment of the fixed-rate tender procedure
7.4.2011	Main Interest rate raise	Deposit facility rate raised by 0.25 basis points to 0.50%
7.7.2011	Main interest rate raise	Main refinancing operations rate raised by 25 basis points to 1.50%, as well as marginal lending facility to 2.25% and deposit facility rate to 0.75%
4.8.2011	Refinancing operations	Launch of a six-month liquidity-providing long-term refinancing operation
3.11.2011	Main interest rate cut	Main refinancing operations rate cut by 25 basis points to 1.25%, as well as marginal lending facility to 2.00% and deposit facility rate to 0.50%
8.12.2011	Main interest rate cut	Main refinancing operations rate cut by 25 basis points to 1.00%, as well as marginal lending facility to 1.75% and deposit facility rate to 0.25%
5.7.2012	Main interest rate cut	Main refinancing operations rate cut by 25 basis points to 0.75%, as well as marginal lending facility to 1.50% and deposit facility rate to 0.00%
2.5.2013	Main interest rate cut	Main refinancing operations rate cut by 25 basis points to 0.50%, the marginal lending facility by 50 basis points to 1.00% and deposit facility rate kept as 0.00%
7.11.2013	Main interest rate cut	Main refinancing operations rate cut by 25 basis points to 0.25%, as well as the marginal lending facility to 0.75% and deposit facility rate kept as 0.00%
5.6.2014	Main interest rate cut, TLTRO	Main refinancing operations rate cut by 10 basis points to 0.15%, the marginal lending facility cut by 35 basis points to 0.40% and deposit facility rate by 10 basis point to -0.10%. Launch of the TLTRO program
4.9.2014	Main interest rate cut	Main refinancing operations rate cut by 10 basis points to 0.05%, as well as the marginal lending facility to 0.30% and deposit facility rate to -0.20%
3.12.2015	Main interest rate cut	Deposit facility rate cut by 10 basis points to -0.30%
10.3.2016	Main interest rate cut, QE, TLTRO II	Main refinancing operations rate cut by 5 basis points to 0.00%, as well as the marginal lending facility to 0.25% and deposit facility rate by 10 basis points to -0.40%. Launch of TLTRO II and further QE
2.6.2016	Corporate sector purchase program (CSPP)	Launch of the CSPP
8.12.2016	Continuation of the APP	Decided to continue the asset purchase program, 80b. euros per month
7.3.2019	Launch of the TLTRO III	Launch of the targeted long-term refinancing operations (TLTRO III)
12.9.2019	Main interest rate cut, APP	Deposit facility rate cut by 10 basis points to -0.50%, relaunch of the net purchased under the APP
23.1.2020	Review of the ECBs strategy	Launch of a program aiming to review the ECBs monetary policy strategy

4 Unconventional monetary policies

Compared to so-called conventional monetary policies, the unconventional policies are monetary policies that are not stated in the central bank's original mandate. In this chapter the paper follows the classification by Dell'Ariccia, Rabanal and Sandri (2018) and scrutinizes three distinct groups of the unconventional policies: a) quantitative easing, b) negative interest rate policies, and finally, c) forwards guidance. The aim of this is to understand why the ECB decided to introduce these policies before moving to analyze the negative impacts of the policies within the euro area and concluding estimates for the Finnish economy. Most attention will be drawn to the negative interest rate policies (hereafter NIRP) due to the arguments that the low-interest rate regime has enabled zombie companies to survive, hence lowering total productivity. (Banerjee & Hofmann, 2018)

4.1 Quantitative easing

Quantitative easing or as known in the euro area as the asset purchase program (APP) are monetary policies that aim to add money supply to the markets through large-scale asset purchase programs (hereafter LSAP), such as buying government bonds. Paradoxically as described by the famous words by the former Fed Chairman Ben Bernanke (2014, p.14) the *"… QE is it works in practice, but it doesn't work in theory"*, the empirical evidence behind quantitative easing has strong academic proof. Chen, Cúrdiaa and Ferrero (2012) model the macroeconomic impact of the large-scale asset-buying program in their research arguing, that the recent policy implementations have a long-term impact on the GDP level. Moreover, when using the US data as an example Chen et al. (2012) discover that the closer the interest rate environment is to zero-lower bound (hereafter ZLB) the greater is the LSAPs impact on the inflation rate and GDP growth.

The APP in the euro area was first launched in the aftermath of the global financial- and following the euro crisis in 2015 designed to boost up the lagging consumption and inflation. Andrade et al. (2016) scrutinize the early impacts of newly implemented policies in the euro area and discover that the policies have a positive impact on both economic growth and inflation.

Moreover, they present that the increase in future uncertainty leads to the expected level of long-term inflation's deviating from the ECBs price stability object. The APP is successful in steering inflation towards the ECB's target range, which they refer to as "*the reanchoring channel*" (2016, p.4). Andrade et al. further estimate that the APPs impact corresponded a 1 percentage point interest rate cut, which can be considered as remarkably good results. The longer the maturity of the asset was, the greater was the impact, which is due to the growing risk that comes with greater maturity. They referred to the phenomena as the duration risk channel. However, Andrade et al. (2016) discover that if policymakers decide to utilize multiple nonconventional monetary policies simultaneously, such as APPs and forward guidance, the impact of those policies is reinforced.

Mouabbi and Sahuc (2019) further scrutinize the impacts of unconventional monetary policies within the euro area. By utilizing results from a dynamic stochastic general equilibrium model[4] (hereafter DSGE model) they argue that the policies are the reason why the euro area can avoid deflation between the time period of Q2/2015-Q1/2017. Numerically the annual inflation is 0.61% higher than it would have been without the nonconventional policies. Their model presents that the three unconventional policies, forward guidance, TLRTO, and asset-buying programs, can raise quarterly measured GDP and investments in 2017 by 4.5% and 8.0%, respectively.

[4] Dynamic Stochastic General Equilibrium models, or DSGE models, refers to a specific econometric model used to estimate fiscal policies effect on the economy usually from a macro viewpoint

The results by Mouabbi and Sahuc (2019) are in line with the early assessments by Andrade et al. (2016) and support their results. The APPs combined with the other unconventional policies have had a positive correlation on the euro area economy, but the inflation anchoring yet remains a problem by keeping to year-on-year (hereafter y-o-y) inflation under the targeted level.

As Mouabbi and Sahuc (2019), Cova, Pagano and Pisani (2015) model the APP effects on the real economy and inflation with a DSGE model. By analyzing the APPs' impact on the demand for long-term bonds, Cova et al. (2015) argue, that due to the unconventional monetary policies GDP and inflation grew by 1.4% and 0.8%, respectively. They present that the improvement is due to a reduction in the transaction costs which in return has a positive impact on private consumption in the euro area economy. Further Cova et al. (2015) demonstrate how the lowered cost leads to an increase in the demand, which in return increases inflation. Dell'Ariccia et al. (2018) conclude that a great majority of the academic literature results which scrutinize unconventional monetary policies impact within the euro and which results are presented in figure 6. The table which Dell'Ariccia et al. (2018) summarize can be found in the appendix, which was also used to draft the scatter plot. By utilizing the results from their article, the result is presented in the scatter plot, figure 6., which demonstrates the correlation between economic growth and inflation.

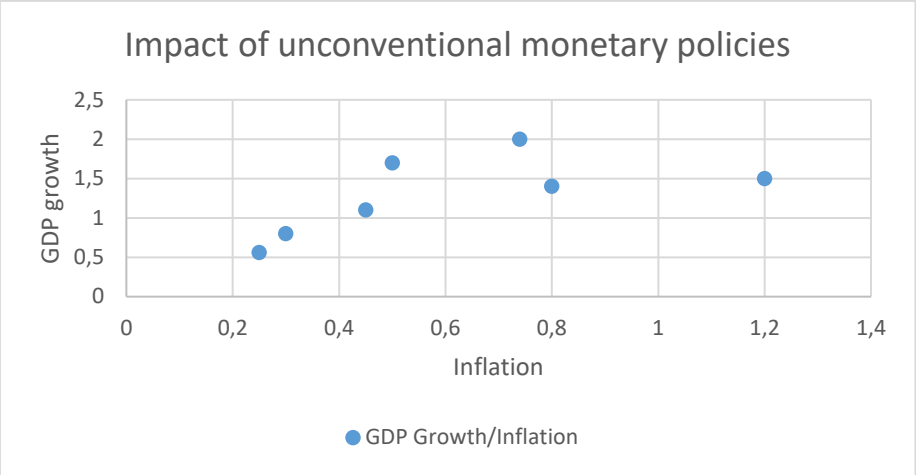

Figure 6 The relationship between economic growth and inflation, (Dell'Ariccia et al., 2018)

From the 14 papers which are mentioned in the article, seven present quantitative results for both economic growth and inflation. The remaining seven focuses scrutinizing the impacts on the government bond yields and the full table used in the paper by Dell'Ariccia et al. (2018) can be found in the appendix section of this paper. By plotting the results in figure 6., it is possible to see that even the most conservative estimates argue that the policies have had a significant impact on the euro area economy. Albeit, it is important to acknowledge that the articles which are included in the Dell'Ariccia et al. (2018) paper do not only scrutinize APPs but as well impact forward guidance, negative interest rate policies, and LTROs. However, it provides valuable insight into academia and provides tools to argue that the newly adopted policies have had the desired outcome.

4.1.1 APPs transmission mechanisms

As presented earlier, the aim of the ECB's asset purchase programs is to increase the demand for liquidity and improve the financial stability within the euro area. To achieve this objective the APPs, have three distinct transmission mechanisms to affect the euro area economy. The first mechanism is the portfolio-balance channel, which refers to investor preference adjustments.

The second mechanism is the signaling mechanism, which argues that the central banks' purchase programs send a signal to the markets about the longevity of the program, which affects the investors' behavior. Further, the third mechanism through which the APPs affect the demand is through reducing future uncertainty, which improves future expectations (Weale & Wieladek, 2016). Alas, it is important to acknowledge that the APPs utilize all the transmission mechanisms simultaneously, compared to just one.

4.1.2 Definition of the mechanism

The theory behind the impact of the portfolio-balance channel to the demand is argued by Vayanos and Vila (2009). In their article, they present a preferred-habitat model which demonstrate how the different type of investor has different preferences for bond maturities which reflects the APPs transfer mechanism. Investor and especially arbitrageurs tend to be risk-averse, meaning that they prefer assets which possess less risk to which Vayanos and Villa (2009, p.31) refer as following: *"…arbitrageurs are risk averse, shocks to clienteles' demand for bonds affect the term structure—and constitute an additional determinant of bond prices to current and expected future short rates."* By shifting from excess reserves to riskier investments the banks and other financial institutions can boost up the euro area economy by allocating capital to investments that would not be as lucrative in a conventional interest rate environment. However, as demonstrated in the upcoming chapters the misallocation of capital is one of the key drivers for the increasing number of zombie companies in the economy. Furthermore, Gagnon et al. (2018) present by using data from the United States that the most significant transfer mechanism for the large-scale asset purchase programs is the portfolio balance channel and in particular is the source of the long-term transfer mechanism. Gagnon et al. (2018, p.9) argue that the so-called *"market function effects"* can be stronger in the short-term, but in the long-term, the balance effect will overrule the other effects.

The second transfer mechanism which Weale and Wieladek (2016) present is the signaling mechanism which is introduced by Eggertsson and Woodford (2003) in their article which discusses the zero bound limits to interest rates. They argue that central banks should only use signaling if they are committed to the policies, otherwise it can be harmful to their future credibility and cause capital losses.

However, they present that signaling as a monetary policy tool is not as strong as asset purchase programs, due to the reason that when signaling central bankers are always committed only to a certain time period, not for a certain price level (2003). To the contrary to Eggertssons and Woodfords (2003) results, Bauer and Rudebusch (2013) present a far stronger case for the positive impacts of the signaling channel. By scrutinizing the impacts on the Feds' first large-scale asset purchase program, Bauer and Rudebusch (2013) discover a statistically strong signaling channel. In particular, the signaling channel is especially clear when examining market expectations after the announcement of the purchase program and they argue that the signaling channel could impact all fixed income asset classes by lowering the interest rates (2013).

The third channel which is argued is the management of future expectations by lowering the uncertainty surrounding the unknown and it is closely linked to the second mechanism, the signaling channel. If the central banks can lower the uncertainty of the future, it will have a positive impact on GDP growth and inflation (Weale & Wiedelak, 2016). The theory behind the outcome is that by reducing the uncertainty of future economic conditions and outcomes, it will have a positive impact on the real future GDP levels.

4.2 Forward guidance

As presented earlier, one of the most important non-conventional monetary policies which were implemented after the global financial crises is forward guidance: a signaling tool that aims to reduce future uncertainty and therefore improve future economic conditions. One of the most known examples of the forward guidance is the speech of the former ECB president Mario Draghi in London, 2012 which later became known as the "Whatever it takes" speech where he reassured to markets by the willpower of the ECB. The speech by Mario Draghi presents the qualitative nature of the forward guidance; by setting a non-numerical target Draghi is able to leave the maturity open, which is also known as time-contingent forward guidance. Contrary to qualitative nature, forward guidance can as well be quantitative by setting a specific target, such as unemployment level (Dell'Ariccia et al., 2018) which can also be described as state-contingent commitment. By signaling a specific numerical target, the monetary policies are expected to continue as long as needed to reach the said goal.

The ECB conducts the forward guidance through press meetings and statements after the Government Council meetings pursuing to be as clear as possible when signaling new policy movements and changes in the economic outlook within the euro area. There has been a drastic change in the past 20 years in policy communication from the central bankers. In particular, when former ECB president Mario Draghi and vice-president Vítor Constâncio addressed the stance to forward guidance in a press conference on the 4th of July, 2013, Bletzinger and Wieland (2016, p.4) referred to it as an "*unprecedented step of stating its expectations"*.

Albeit being a powerful tool, whether or not the forward guidance is effective depends on three things: a) is the guidance seen as a clear commitment, b) is the message clear, and finally, c) does the audience interpret the message as the central bank had planned to (Filardo & Hofman, 2014). If the interest groups consider the message to be vain and not signal a clear commitment to fulfilling the policies, the impact will not be powerful.

In the same sense, if the message is not clear and easily understandable the markets may not react as wished, hence there is great stress on the language when signaling future policies. By analyzing the impacts of four different central banks and the impact of their forward guidance policies, Filardo and Hofman (2014) argue that the policies were successful to reduce the expectations of market volatility. However, the results for the expectations regarding interest rates were mixed which Filardo and Hofman (2014) explain to be due to mixed results across economies and time-periods, hence a clear result is hard to conclude.

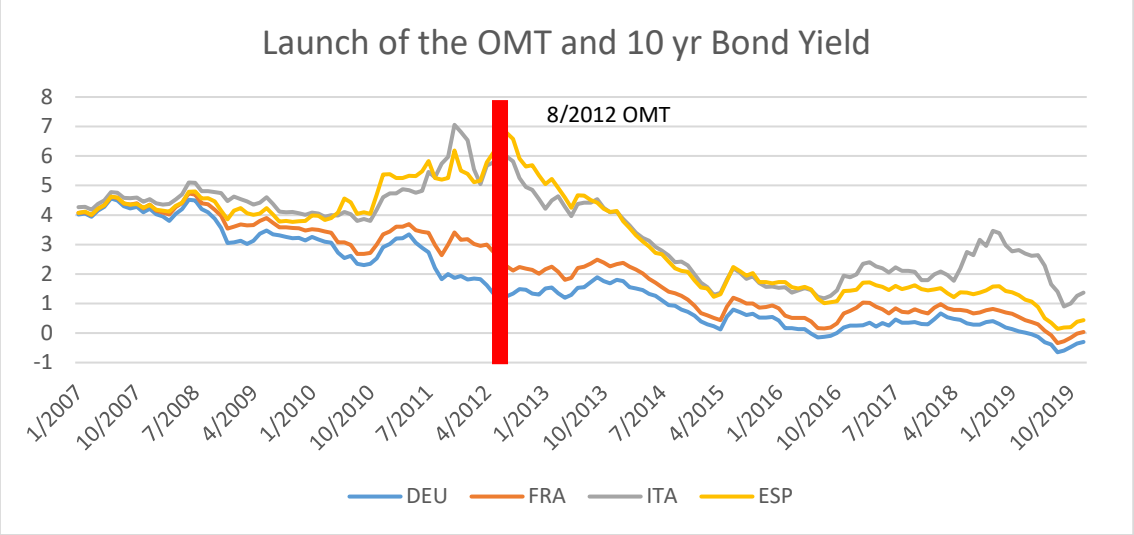

Figure 7 Launch of the OMT and 10-year bond yields 2007-2019, (Federal Reserve Bank of St. Louis, 2020)

By taking a look at figure 7., which portrays the 10-year treasury bond yields of France, Germany, Italy, and Spain a drastic change can be seen after the announcement of the Outright Monetary Transactions-program (henceforth OMT) in august 2012. Albeit, not being the only variable affecting the yield curve, it had a significant impact on market expectations by revealing ECB's commitment to keeping the single currency union intact.

As Filardo and Hofmann (2014) present the forward guidance is able to reduce market volatility within the euro area, Japan, the USA, and Great Britain. Brand, Buncic and Turunen (2010) further scrutinize the phenomena by focusing on the transfer time between announcement and market reaction in the euro area. By utilizing high-frequency data Brand et al. (2010) argue that the biggest surprises, i.e. market movements, occurred in the early years of the ECB when markets were not as efficient predicting the policy announcement. However, in the last years of the sample period used in the research, the market movements were not as big surrounding the immediate announcement of the Government Council.

This suggests that the markets have been improving their predicting skills and priced the impact of the announcements to the assets in advance (2010) making the markets more efficient. In particular, within the euro area, the forward policies conducted by the ECB has been able to lower the expectations for private short-term interest rates. Furthermore, the effect has been more significant on interest rates with longer maturities, which hints that the markets conduct the ECBs announcements more as a window to the future than a macroeconomic outlook (Hubert & Labondance, 2016). Hence, the ZLB environment is not conventional, the forward policies have been utterly important by reducing market volatility around the future expectations. Albeit, they have not been able to raise the lagging inflation levels within the euro area, which the NIRP and QE have tried to tackle. For this reason, scrutinizing the theoretical background of NIRP is needed to be able to assess the cons and pros.

4.3 Negative interest rate polices

Negative interest rate policies (henceforth NIRP) became part of the central bankers' toolkit after the great financial crises and are still implemented within the euro area by ECB. The aim of the policies is that by lowering the interest rates offered to commercial banks, the banks are pushed to seek alternative investments that provide better yield and lower the margins offered to the consumers.

By charging the banks for holding deposits on their accounts reducing the incentives to continue this behavior and by doing this, the banks are adding liquidity to the economy and boosting the consumption which in return increases the inflation, which has been lagging behind the desired level for years. By implementing NIRP the ECB introduced a direct cost on the excess liquidity which the banks behold and giving the banks a strong incentive to reduce this cost by reducing the amount of excess liquidity in their balance sheets. Demiralp, Eisenschmidt and Vlassopoulos (2019) provide two reasons why banks are increasing their lending under low-interest-rate levels and strengthening the bank-lending channel.

First, as presented above, the NIRP imposes a direct cost on excess reserves which leads to greater incentives to reduce the costs on holdings, and hence increase the lending. Despite the reducing margins, by increasing the amount of loans banks have the opportunity to obtain yield in the low-interest-rate environment.

The second aspect that Demiralp et al. (2019, p. 10) present is that "…*the zero lower bound on deposit rates leads to a decrease in the opportunity cost of holding retail deposits and increases the demand for such deposits."* To answer this increasing inflow of deposits, banks can have the incentive to react by issuing more loans. By using cross-country data which included 252 euro area banks Demiralp et al. (2019) discover that the NIRP has a positive impact on the issuance of loans. In particular, the phenomena were prominent in those commercial banks which had a relatively larger share of excess reserves and hence were more impacted by the unconventional monetary policies. Furthermore, banks that were especially dependent on retail deposits increase the lending to private consumers and companies with lower margins.

By March 2020 the respected interest rates offered by central banks have fallen below zero lower bound (henceforth ZLB) in two of the four major central banks[5]: The Bank of Japan and ECB. The first major central bank was the ECB to implement negative rates in June 2014 and Japan followed up in the first quarter of 2016 by introducing negative rates to the overnight call rate.

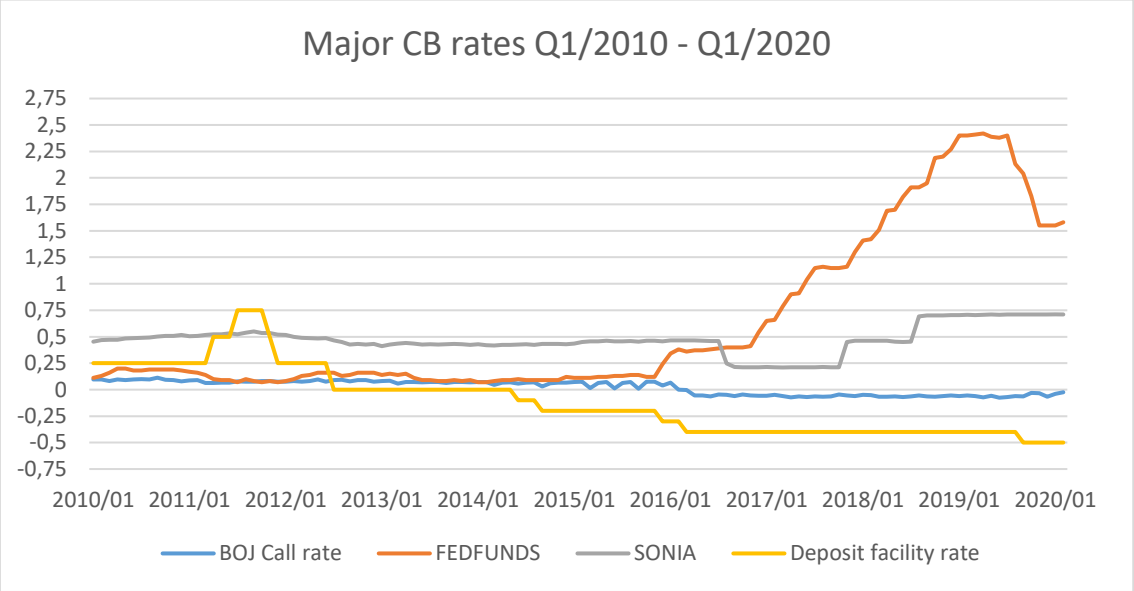

Figure 8 ECB, FED, BoJ and BOE main interest rates (Eurostat, 2020b; FRED, 2020; BoE, 2020; BoJ, 2020)

By updating the table used in the research by Jobst and Lin (2016, p.4) and using the same benchmark rates, the development of the four main central banks and their respected interest rates can be seen. The rates used to construct figure 8. are the deposit facility rate for ECB, call rate for Bank of Japan, Sterling overnight index average rate for Bank of England, and federal funds rate for the Federal Reserve. From the four major rates, only SONIA and Federal funds rate have stayed above ZLB, even though in 2013 the rate fell below 0.10 percentage points and stayed below for six consecutive quarters.

[5] The four major central banks are the Bank of Japan, the Federal Reserve System, Bank of England, and the European Central Bank

In addition to the major central banks presented above, negative interest rate policies have also been implemented by the Danmarks Nationalbank and the Central Bank of Hungary in 2014 followed by Sveriges Riksbank, Norges Bank, and the Swiss National Bank in 2015 (Jobst & Lin, 2016). However, both the Norges Bank and Sveriges Riksbank decided to shift away from the negative interest rates in 2019, respectively, and raise the respected deposit facility and repo rate to 0.00%. Albeit, during the announcement of the raise, the Swedish inflation had not reached the annual 2% target level set by the Riksbanken and it has been argued that the decision was due to the ongoing criticism towards negative rates (SEB, 2019).

However, the early studies suggest that the euro area has benefitted from the ongoing negative interest rate policies by having a small, but a positive effect on the economy and managing to lower the price of capital (Jobst & Lin, 2016; IMF, 2017). The euro area bank lending survey (henceforth BLS) which is a quarterly published survey conducted by the ECB demonstrates the banking industry's development and insight of the markets. The first BLS where a question regarding the possible effects of NIRP was included in April 2016 and the questionnaire was answered by 141 banks and highlighted the five biggest economies within the monetary union; France, Germany, Italy, Spain, and the Netherlands. The April 2016 survey reveals that the low-interest rate level is seen as a significant driver behind the increase in housing loans in France, Germany, Italy, and the Netherlands, where 98% of the recipients agree with the statement.

All recipients excluding the Netherlands recognized the phenomena that the low-interest rate level has a significant effect on the increase of demand for consumer credit. Even though the low-interest rate level has a positive impact on both the demand for housing loans and consumer credit, ¾ of the banks reported that their interest income had declined due to the low rates. Over a third of the banks reported that the negative rates had been forced to lower the loan margins and almost 50% argued that the low lending rates were due to the NIRP, which can partly explain the increase in the demand for consumer loans (European Central Bank, 2016b).

Compared to the United States which is a market-based economy, the euro area is a predominantly bank-based economy so the NIRP is inherently a more suitable tool to boost the economy through bank lending. By scrutinizing the volume change in the newly issued loans to corporates and margin changes Bräuning and Wu (2017) explore the passthrough of the interest rate announcement conducted by the ECB. They notice that in the aftermath of so-called surprise policy announcements the short-term loans, which they define as loans with maturity between 3-months and up to 1-year, the interest rate cut lowers the loan marginals significantly.

According to Bräuning and Wu (2017), the NIRP has managed to lower the short-term loan margins, but when scrutinizing the impacts on the multitude of newly issued loans, they discover some heterogeneity in the results. By examining the four biggest economies, France, Germany, Spain, and Italy, surprisingly Bräuning and Wu argue that the strongest response to NIRP was in France and Italy while the weakest response was in Spain and Germany. However, it is important to acknowledge as mentioned before that the impact of NIRP relays on the market structure of each country. If the main source of capital in an economy is through financial markets, such as the issuance of corporate bonds or initial public offerings, the NIRP will not have an as strong impact as it would have in an economy where the main source of financing is through bank loans. Albeit the heterogeneity, the results indicate that the NIRP has a significant impact on the loan margins by lowering them and it had been successful to increase the commercial banks' lending volumes throughout the four biggest euro area economies (2017.)

The BLS conducted in January 2020 included the same nations as the survey in April 2016 with the difference that the Netherlands was no longer highlighted as an individual economy and only as a part of the whole sample. Compared to the first survey where the NIRP had been implemented and was a part of the survey, the January 2020 results were remarkably in line. There has been very little change in the survey and the questions are standardized so comparing results over time is possible.

As well as in the April 2016 survey (European Central Bank, 2016b) all the major economies, excluding Spain, agree that the low-interest rate level has been a significant driver behind the increase of house loans within the respected economies. Furthermore, the same phenomena are visible in the revised survey when scrutinizing the development of the demand for consumer credit. On average, 17% of the banks which attained the survey agree, that the general level of interest has a significant impact on the demand of consumer debt.

However, between the nations there is strong volatility in the answers: in France, 29% agreed with the statement compared to Spain, where the share of answers who agreed with the statement was zero (European Central Bank, 2020c). Even though the promising results from the early surveys Eisenshmidt and Smets (2019) present that the results could be even better if the banks are more willing to implement negative interest rates on deposits. In a world where cash would not be an option, implementing negative rates to deposits would be convenient, but due to the alternative nature of cash as value storage, banks are faced with the fear of deposit runs if the interest rates would fall too low. Hence the lagging transfer mechanism, the term “sticky deposit” is used to describe the problematic nature of the phenomena which hinders the NIRP to fully utilize its power.

5 Negative side effects of the NIRP

Albeit the promising results the NIRP has had in the euro area, by stimulating economic growth, there have been arguments that the policies have caused more harm than good or even be built on false theoretical assumptions (Palley, 2016a; Banerjee & Hofmann, 2018). NIRP has in particular been criticized due to three factors. First, the policy is built on a flawed theory that by manipulating interest rates policymakers can obtain full employment (Palley, 2016a). Secondly, NIRP has been criticized due to the reason that it causes problems for the financial sector through resource reallocation. Further, the unconventional interest rate policies have created an environment where financial institutions have been forced to seek yield through alternative investment classes, hence jeopardizing the financial stability (Palley, 2016b). Prior to the introduction of the NIRP, financial institutions were able to deposit assets to the central banks and receive interest. Due to the introduction of the unconventional policies, this alternative has no longer be profitable, and it has forced financial institutions to seek yield from alternative, riskier asset classes. The third negative side-effect which is argued to be due to the NIRP (Banerjee & Hofmann, 2018) is that the lower interest rate environment has been a driver behind the increasing share of zombie companies in the economy. Companies that are no longer productive and are solely existing due to the low-interest-rate environment are according to the Schumpeterian growth theory impacting the economy's total productivity by lowering it. In the next chapters, this paper will go through the negative side-effects while taking an emphasis on the increasing numbers of zombie companies in the economy.

5.1 Financial stability

When the interest rate levels have fallen below zero-lower bound territory the portfolio rebalance channel has strengthened encouraging commercial banks and other financial institutions to seek yield for alternative asset classes.

Before the negative rates were implemented in the euro area, banks were able to deposit their excess liquidity to the ECB and receive a yield on the deposit as presented in the earlier chapters. However, after the introduction of the negative deposit facility rates in 2014 the incentives to make deposit has reduced significantly and encourages banks to allocate their resources to other investment classes. Critics argue that by eliminating a virtually safe investment class the NIRP is imposing a risk to the banks and the financial system as a whole through the portfolio rebalancing channel.

Bottero et al. (2019) scrutinize the impact of NIRP within the euro area by using data from the Italian banking sector as a tool to model the effects of the unconventional policies to bank's risk-taking behavior. Even though the portfolio rebalance channel has affected the bank's behavior before the interest rates went below ZLB, the rate cuts in the negative territory have had a stronger impact on the bank's incentives. By defining riskier asset classes to be assets which are not liquid, Bottero et al. (2019) discover that by using microlevel data, banks shift to riskier credit asset under the NIRP environment. This confirms the functioning of the portfolio rebalancing channel. Microlevel bank data reveal that rate cuts which were implemented under the NIRP environment especially increased loans to small businesses that possess more risk. Bottero et al. (2019) stress that the same portfolio rebalancing is not seen when the rate level is on the conventional level above zero.

By undertaking riskier projects and allocating excess capital to alternative asset classes, the NIRP has been argued to cause financial bubbles jeopardizing financial stability as a whole. Financial institutions, such as banks and pension funds are obligated to reach a targeted rate of return to fulfill their mandate to the interest groups. By encouraging financial institutions to seek yield from new asset classes there is a danger of forming price bubbles. In particular, if the excess liquidity is drawn to the housing markets the bubbles are especially detrimental and causing severe damages to the economy if collapsing (Claessens, Kose & Terrones, 2012).

Albeit apart from Sweden where the housing market is significantly different from the rest of the NIRP implemented countries, the economies where NIRP has been implemented there has not been seen a drastic rise in housing prices that can be argued to be due to the unconventional monetary policies (Arteta et al., 2018). Furthermore, by imposing a tax on the excess reserves and pushing banks to undertake more risk and simultaneously reducing the loan margins, the NIRP has been argued to reduce bank profitability. This is especially prominent in countries where the majority of the loan base has adjustable loan rate margins (henceforth ARM). For example, in the euro area, the ARMs are predominant in countries such as Greece, Australia, Italy, Portugal, and Spain whereas loans with fixed-rate margins (henceforth FRM) are more common in Belgium, France, Germany, and the Netherlands (Albertazzi, Fringuellotti & Ongena, 2018). In the countries where the majority of the loan portfolio is ARM, the banks are at a significantly greater risk to face a decline in their revenues when to margins fall. For example, after the introduction of the NIRP in the euro area in 2014, one of the most widely used reference rates for ARMs in Finland, the 12-month Euribor rate, has declined substantially which is presented graphically in figure 9. below.

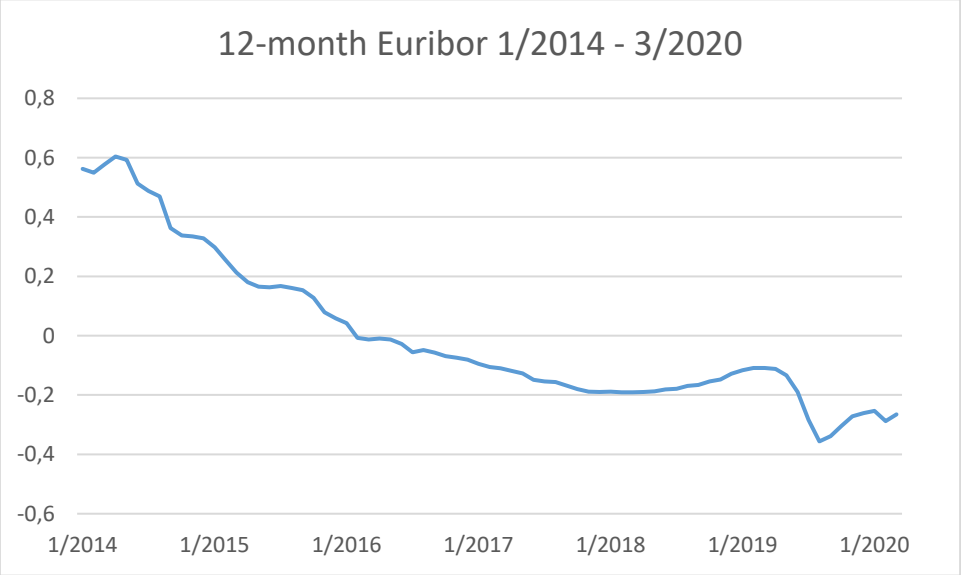

Figure 9 12-month Euribor rate monthly composition (Suomen Pankki, 2020)

The decline in the benchmark rates such as the 12-month Euribor rate has led to a situation where the margins of ARMs have fallen and increased the demand for loans (European Central Bank, 2020) but simultaneously causing stress to the financial health of the banking industry. However, it is important to understand that the transmission mechanism has not been identical in all cases, banks and other financial institutions which have issued a greater share of ARM loans have been impacted more than the banks with FRM loan portfolios, which portrays the idiosyncratic nature of the NIRPs impact.

5.2 Prolonged effects

The low-interest-rate level and NIRP in particular are argued to cause stress to the strength of the financial institutions and a characteristic which have portrayed the era after the global financial crisis is the prolonged rate environment. The interest rate level which has declined to a historically low level and has not given any signals of retracting to the pre-crisis level has raised concerns regarding the long-term effects on the institutions and the financial structure as a whole.

Bank of International Settlements (henceforth BIS) Committee on the Global Financial System (henceforth CGFS) scrutinizes the impact of a “low-for-long” scenario where the interest rate environment would not recover to the original level and how the new normal would affect the banking industry and pension funds (2018). They present five channels of how the prolonged low-interest-rate territory will affect banks and other financial institutions if the rates would not return to the pre-financial crisis level. The first aspect which the CGFS point to cause stress to the financial system is that a portion of banks that are focused on deposit and retail lending are under pressure in a competitive market even though some institutions be left unharmed of the low rate levels. Secondly, in the aftermath of the global financial crisis, a wave of new regulation such as capital requirements have been introduced to the banking industry which if prolonged can harm the profitability of the banks.

The third aspect on the other hand which CGFS point out is that even though the majority of pension funds are able to cope and survive under the low-interest-rate environment, a portion of the companies are not, which can lead to "*experiency solvency of problems"* (2018, p.2) and if done wrong, can backfire and cause severe damage to the financial system as a whole.

The fourth risk which the BIS in the CGFS (2018) identify in the prolonged environment of unusually low-interest rates is the so-called snapback of the interest rates. They refer to this as a phenomenon were to interest rates would suddenly jump back to the pre-crisis levels. The sudden snapback of interest rates would have a similar effect of a negative shock where the already adapted institutions would face a sudden, idiosyncratic shock to their business model. The CGFS report estimate that a sudden snapback would lead to bank *"experience valuation losses on long-duration assets and credit losses on loans" (2018, p.2).* Furthermore, a sudden snapback would lead to significant losses to both pension funds and banks which would have taken issued or bought derivates if the positions would not be favorable from their standpoint (2018). The fifth aspect which the article lifts as a possible negative scenario is that the low-interest-rate environment could lead to the birth of asset bubbles and following up crashes. However, this final scene is only briefly discussed in the report and left to further research (2018).

As seen, NIRP has faced criticism from many directions, but arguably the most severe negative side effect is the zombie companies. A low-interest rate level environment has been argued to increase the share of these companies in the economy and the next chapter of this paper will scrutinize the impact they have on the economy. Before estimating the presence of zombie companies in the Finnish economy and if there are any industries that are especially vulnerable this paper will as well examine the endogenous innovation-based growth theories.

6 Zombie companies

Zombie companies, as explained earlier, are companies which productivity is too low and under normal interest rate circumstances, the cost of capital would be too high, and should hence, according to the financial theories disappear from the markets. By doing so, the freed capital and labor would move to more productive firms and increase the total productivity of the economy. In chapter 6.2. this paper will scrutinize the impact of the absence of the exit mechanism from the viewpoint of the endogenous innovation-based growth theories which are the product variety model and Schumpeterian growth model. However, before examining the growth theories it is important to understand the definition, magnitude, and theoretical background of the zombie company phenomena.

In the previous chapter, this paper has gone through the negative side effects of both NIRP and zombie companies as argued by Banerjee and Hofmann (2018) and Caballero et al. (2008). Banarjee and Hofmann (2018) argue that the term zombie companies and zombification, a state of the economy where the share of zombie companies is great, derives from the research by Caballero et al. (2008). Caballero et al. (2008) examine the phenomena known as the lost decade of Japan in the 1990s. Due to legislation changes, financial institutions were able to lend credit to companies that would not be able to obtain the same amount of credit under the previous legislation. For the ability to obtain capital these companies were able to survive without being washed away in a normal competitive market. Due to these companies being “alive” even though they should have been abolished i.e. “dead”, Caballero et al. (2008, p.3) decide to call these “*unprofitable borrowers”* zombie companies and the state of the economy as zombification. They further specify that these unprofitable borrowers which caused significant harm to the Japanese economy in the 1990s are companies that fulfill the following criteria: zombie companies are companies that have received or are receiving subsidized credit.

In many cases, zombie companies are defined through profitability levels and other financial ratios. However, as Caballero et al. (2008) present, that by utilizing financial ratios many industries would be classified as zombies due to their industry's characteristics. This is taking into account in the estimates used in this paper which are presented in chapter 7. Hence, using a more sophisticated model can be argued as the results examined. By using this method, they are able to find out that the percentage of zombie companies in the dataset is between 5-15% before the year 1994 when it rising to the staggering number of 25%. Even the weighted share of zombie companies, where the size of the companies is taken into consideration, is roughly 15% from 1994 onwards. Even though the dataset can not consider all companies due to missing variables, is the amount still significant. Further, the dataset is divided into five industries which are: manufacturing, construction, real estate, trade, and services. By taking a closer look at the individual industries Caballero et al. (2008) discover that non-manufacturing industries are more likely to attract zombie companies compared to manufacturing industries.

During the 1990s Japanese manufacturing companies faced strong competition from abroad, a never seen before situation for the Japanese. Japan had for long dominated the technology market and their American rivals had been in trouble merely copying their competitor's innovations. However, during the 1990s foreign competitors were capable to challenge the Japanese manufacturers, and Caballero et al. (2008, p.11) present that the companies in Japan could not have survived the competition without complex and significant subsidy packages from the government. According to the Schumpeterian growth theory, which is scrutinized in more detail in the upcoming chapter, the exit i.e. companies going away from the markets, is essential for the growth of total productivity and hence to economic growth. Zombie companies are however creating a bottleneck where companies with low productivity are no longer exiting the markets and hindering growth.

Caballero et al. (2008) notice this phenomenon in Japan where the number of exits is lower in industries that have more zombie companies. In industries where the number of zombie companies is lower, the exits are regularly more common. Moreover, the total factor productivity (henceforth TFP) is lower in the industries where the number of zombie companies is higher The TFP formula in the simplest Cobb-Douglas form is presented below where the TFP is the output (Y) divided by the input ($K^{\alpha} L^{1-\alpha}$).

$$\frac{Y}{K^{\alpha}L^{1-\alpha}} = A = TFP \tag{6}$$

By having throughout smaller TFP levels Caballero et al. (2008, p.37) estimate that the "*key characteristic of our mechanism is that zombies create on-going distortions that lower job creation and industry productivity"*. Further, they conclude that in the absence of the zombie company's estate developers can have up to 9.5% greater employment growth what they had under the observation period.

Another research scrutinizing the impact of zombie companies but from the viewpoint of OECD countries is concluded by Adalet McGowan, Andrews & Millot (2017). They use the same framework as Caballero et al. (2008) present in their respected article for the Japanese economy, which examined earlier. However, compared to Caballero et al. (2008) Adalet McGowan et al. (2017, p.6) define zombie companies as *"…old firms that have persistent problems meeting their interest payments…"* which Caballero et al. (2008) present more broadly as unprofitable borrowers. Besides using data from OECD countries, the dataset is broader including more observations than the research by Caballero et al. (2008). Interestingly Adalet McGowan et al. (2017) observe that in industries where the presence of zombie companies is significant, there is a crowding-out phenomenon where non-zombies could not attain the same amount of capital that they could have in a perfect market situation. They estimate that the non-zombie companies would have up to a 2% higher investment level if the zombie companies would not exist (Adalet McGowan et al., 2017).

Furthermore, zombie companies that are obtaining capital are as well making it harder for new, young entrepreneurs to enter the market which could lead to innovations and overall improve the total productivity of the economy. The next chapter will present evidence of how entries and competition are utterly crucial for the economy and why barriers to entries are causing significant damage to the economy.

The second harmful effect which Adalet McGowan et al. (2017) are able to identify which derive from the presence of zombies is the drastic divergence of multi-factor productivity (henceforth MFP) between the zombie and non-zombie companies. OECD defines MFP as a measure that tells the relationship between the number of inputs, such as labor and capital used together to produce an output, and how efficient that process is. It is important to notice, that MFP which is a residual is also known as TFP and the terms are in many cases used interchangeably. The syntax of TFP is defined earlier in formula 8. They notice that the divergence between MFP performance in a zombie- and non-zombie companies is especially visible among younger companies. However, Hoshi (2006) argues that it is the relatively larger firms among the smaller companies that are more vulnerable to becoming zombies. The motivation behind this argument is rather intuitive and can be expanded to several economies where the presence of zombie companies can be seen. In many countries' politicians have a strong incentive to ensure their re-election by securing high employment levels and profitable companies. To achieve this goal politicians have been granting stimulus packages and direct aid to troubled companies and in many cases, the aid is directed to bigger companies with more employees. Companies that have received government aid have been identified as a group that has shown a significant amount of zombie companies compared to groups that have not received the same aid. However, the method of identifying zombie companies through scrutinizing whether or not they have received aid has its drawbacks.

Hoshi (2006) who uses the methodology argues that the model is able to misidentify companies as zombies if they receive loans with lower margins, which the model picks up as aid even though it is due to the good financial performance. In the same way, companies that would decide to pay back a significant amount of debt and reduce the debt ratio within the reference period would be seen as zombies. However, Hoshi (2006) points out that if the debt ratio reduction is due to creditors' forgiveness and goodwill and not financial performance, there is a likelihood that the debt holder is a zombie. In his model Hoshi (2006) utilize five variables to estimate if companies were in danger of turning into zombies: a) industry, b) location, c) size, d) financial structure, and finally, e) profitability. Especially profitability and financial structure correlate with the probability of zombification because debt-heavy companies that are not as profitable are more likely to receive aid and therefore turn into zombies. In the line of Caballero et al. (2008) Hoshi (2006) identify that zombie companies are more likely to appear in industries that are non-manufacturing and cause the most damage to the non-zombie firms which face difficulties in profitability and capital raising.

Table 4 Regression models for estimating zombie companies.

Author	**Dependent variable**
Banarjee & Hofmann (2018)	Portion of zombie companies in the economy
$Zombie\ share_{sct} = \beta_1(External\ finance\ dependence * Interest\ rate_{ct-1}) + \beta_2(External\ finance\ dependence * Bank\ Health_{ct-1}) + \alpha_s + \gamma_{c,t} + \varepsilon_{sct}$	
Adalet McGowan et al. (2017)	Zombie companies' effect on non-zombies
$Y^k_{isct} = \beta_1 nonZ_{isct} + \beta_2 nonZ_{isct} * Z_{sct} + \beta_3 Firm\ controls_{isct-1} + \delta_{sct} + \varepsilon_{isct}$	
Adalet McGowan et al. (2017)	Zombie companies' effect on resource allocation
$K\ growth_{isct} = \alpha + \beta_1 MFP_{isct-1} + \beta_1 MFP_{isct-1} * Z_{sct} + B_3 Firm\ controls_{isct-1} + \delta_{sct} + \epsilon_{isct}$	
Caballero et al. (2008)	Zombies effect on economic activity (investments, employment, productivity)
$Activity_{ijt} = \delta_1' D_t + \delta_2' D_j + \beta nonz_{ijt} + \chi Z_{jt} + \varphi nonz_{ijt} * Z_{jt} + \varepsilon_{ijt}$	

Table 4. concludes the regression used in the previously mentioned articles by Banarjee and Hofmann (2018), McGowen et al. (2017), and Caballero et al. (2008). Unfortunately, the regressions used by Hoshi (2006) are unable to be found for this paper and are therefore excluded from the summary table.

6.1 Zombies in Europe

Researches by Banerjee and Hofmann (2018), Adalet McGowan et al. (2017), Caballero et al. (2008), and Hoshi (2006) scrutinize the nature of zombie companies and their impact. McGowen et al. (2017) include euro area in their dataset and even then, and only as a part of the OECD countries[6].

[6] The countries used in the McGowen et al. (2017) sample were Belgium, Finland, France, Italy, Republic of Korea, Slovenia, Spain, Sweden and the United Kingdom

As previously presented, the euro area has been suffering from sluggish economic growth and low inflation levels and therefore pushing ECB to lower the main interest rates. As Banerjee and Hofmann (2018) argue in their research, low-interest rate levels correlate with the presence of zombie companies in particularly in industries that relied heavily on external funding. They estimated that (2018, p.74) "*10 percentage point decline in nominal interest rates since the mid-1980s may account for around 17% of the rise in the zombie share in advanced economies when evaluated at the average industry external finance dependency ratio".* Due to the problematic nature of zombie companies and ECB actions to further lower main interest rates, it is important to take emphasis solely on the euro area.

The great financial crises have taken a significant impact on the euro area economy forcing the ECB to take action to prevent possible mass bankruptcy of companies and its devastating impact on the euro area economy. Storz et al. (2017) scrutinize the relationship between banks' behavior and the development of small and medium-sized enterprises (henceforth SME) indebtedness in the euro area in the postcrisis era. They argue that if the banks would act rationally, they would deleverage nonproductive companies protecting their balance sheet when under stress.

However, especially in poorly performing economies [7] they notice the opposite behavior: banks that are under stress do not reduce lending to poorly performing companies and as matter of fact it appeared that they are *"gambling for resurrection"* (Storz et al, 2017, p.3). They present that the increase in bank stress leads to the increase of zombie companies in the euro area, but only in the so-called periphery countries. According to Storz et al (2017) periphery countries, Greece, Ireland, Portugal, Spain, and Slovenia, do not have as strong a banking sector as Germany and France, and therefore have a tendency to "gamble". They demonstrate that stressed banks have strong incentives to evergreen loans to avoid writing them as non-performing loans.

[7] The data sample in Storz et al. (2017) included France, Germany, Greece, Ireland, Portugal, Spain and Slovenia

By doing this, they are gambling that the economy will recover and prevent them from writing the before outstanding loans and non-performing loans off. Furthermore, they present that the share of zombie companies has grown during the reference period in the periphery countries where the banks are weak, but the same phenomena are not seen in Germany and France (Storz et al., 2017).

As well as Storz et al. (2017), Andrews and Petroulakis (2019) focus to scrutinize the relationship between bank behavior and the existence of zombie companies. In the line with the results of Storz et al. (2017), they are able to identify the link between weak banks and the share of zombie companies in the economy. They argue that in an economy where the banks are weak, the banks are between 1.2 -1.8% more likely to be linked with zombie companies. This stronger connection with zombie companies transfers to even a 13-19% larger likelihood of zombie company incidents depending on the country and industry specific variables. It is important to acknowledge, that the data sample is significantly large and include 11 countries [8] and expands over decade long time period hence the variation in the likelihoods.

Furthermore, Andrews and Petroulakis (2019) are able to provide additional proof for earlier researches that scrutinize zombie companies and their effect on total productivity on the economy overall. In the line with Adalet McGowan et al. (2017) Andres and Petroulakis (2019) identify that zombie companies create a barrier for resource allocation and build unnecessary bottlenecks for new entries. By hindering efficient resource allocation, the zombie companies are causing the most damage to new, small firms (Hoshi, 2006; Caballero et al., 2008). Up to a third of the zombie companies' negative impact is on the capital reallocation channel, which is a significant reason for the slowdown of TFP growth (Gopinath et al., 2017), can be argued to be due to weak banks (Andres & Petroulakis, 2019).

[8] The countries are Austria, Denmark, Estonia, France, Germany, Greece, Latvia, Slovenia, Spain, Portugal and United Kingdom

Providing further evidence to the harmful effect of weak banks and zombie lending, Acharya et al. (2019) scrutinize bank behavior after OMT announcements in the euro area. OMT announcements which were implemented starting from 2012 and explained in the earlier chapters, were able to achieve their original goal of improving the health of the banking industry, but with a cost. Acharya et al. (2019) present that after the launch of the OMT-program in 2012, the majority of loans are issued to weak, non-productive companies i.e. zombies which have a strong relationship with banks. They present that up to 8% of the loans issued under the OMT program transferred to zombie companies and not to productive companies, which is in line with the capital misallocation channel theorem. In particular capital misallocation channel is visible in the peripheric countries, which also Storz et al. (2017) present. Acharya et al. (2019) estimate that in Italy up to 19% of loans issued three years after the OMT programs can be classified as nonperforming.

So far, this paper has examined how the share of zombie companies in the economy has increased hand by hand with the low-interest rate level and scrutinized the mechanism of how they affect the economy. The empirical evidence presented by academia is clear, zombie companies hinder economic growth and lower the total productivity. Furthermore, they present hinders to market entries and impact resource allocation by creating bottlenecks. Because the empirical evidence presents a strong proof of the harmful effect of the zombie companies, it is important to understand as well the theoretical background why they are so harmful. Hence the next chapter will show how zombie companies violate the growth theories and why countries should implement measurement to dimmish them from the economy.

6.2 Innovation based growth theories

As described in the previous chapter the proof of the harmful nature of zombie companies and links to low-interest-rate environments and weak banks is self-evident.

However, even though the empirical evidence supporting the theory that market entry and exit should be as frictionless as possible, this paper has not gone through the theoretical background to support the phenomena. By hindering new entries, zombie companies are building barriers to innovations which are crucial to the growth of total productivity and thus economic growth. For the reason that zombie companies are causing the most harm to new, small firms (Adalet McGowan et al. 2017; Andres & Petroulakis, 2019) this paper will focus on the innovation-based growth theories. In the line with the classification made by Aghion and Howitt (2009), the attention will be on the product variety model and Schumpeterian growth model, which puts emphasis on innovations.

From the four main paradigms, the neoclassical growth model and AK-model are excluded from this research because according to them the market exit does not have an effect or has a negative effect on the economy, which Schumpeterian growth theory has proved to be false. Furthermore, the two paradigms do not scrutinize the role of innovations in the economy which are a crucial factor when examining zombie companies' negative effects. The first endogenous innovation-based growth model, the Product variety model, is presented by Romer (1990) and according to the theorem, the source of growth is the amount of variety within the products.

This does not mean that the new products should be superior to the existing ones, but the sheer volume of different intermediate products are the source of growth, according to the product variety model. As previously mentioned, this paper will exclude the neoclassical- and AK growth model due to the reason that they assume perfect competitive markets, where positive profits cannot be achieved. However, if the assumption of perfect markets holds, there are no incentives to invest in research and development (henceforth R&D) and no innovations would be achieved. Therefore, the notion that markets are not perfectly functioning is crucial and supports the argument to focus on the innovation-based models.

According to Aghion and Howitt (2009), the product variety model can be presented by utilizing the Euler equation (9) as the Romer Model with Labor as input for R&D (10).

$$g = \frac{r-\rho}{\varepsilon} \tag{7}$$

$$g = \frac{\alpha\lambda L-\rho}{\alpha+\varepsilon} \tag{8}$$

Where g is growth, λ is the productivity of research activity, L is the size of the economy using total labor as the variable and ρ is time-preference, which determines the saving rate. The notion hints that the larger the economy and the greater the efficiency of research activity are, the greater the economic growth is. However, this logic has a flaw, because it argues that bigger countries with more labor force should always have greater economic growth, which in reality is not true (Aghion and Howitt, 2009).

As presented in the previous chapter, the zombie companies cause bottlenecks which in return causes, according to the product variety model, severe harm to the economy. In many cases new firms who are trying to gain market share are introducing new products, alas many times their lifespan is short, a mechanism to which zombie companies are causing frictions. However, even though the product variety model presents the role of new innovations in the economy is crucial, it fails to explain the role of market exits, which the Schumpeterian growth model presents to be the key to economic growth (Aghion & Howitt, 2009). Both frictionless market entry, which product variety presents, and functioning market exit, which Schumpeterian growth model argues, are the key sources of growth and two mechanisms to which zombie companies cause most damage to.

The second endogenous innovation-based growth model, the Schumpeterian growth model, differs from the product variety model in the sense that it presents that market exit can have and has a positive impact on the economy – an opposite argument of the product variety model (Aghion & Howitt, 2009).

The Schumpeterian growth model which Aghion and Howitt (2009) named after Joseph Schumpeters theory scrutinizing the impact of creative destruction in the economy. Creative destruction, a mechanism which is presented visually in figure 10. adapted from Maliranta (2020) presents the development of the economy's total productive over time where both market entries and exits are frictionless. As seen in the figure 10, the blue dots represent companies and the larger the dot is, the greater is its relative market share in the economy. In the first period, there are only one company, so the total productivity, which is presented as a dotted line, is equal to the company's productivity.

However, in the second period there are two new market entries, but their market share is small and hence they do not have much impact on the total productivity. It is important to notice, that one of the entries is more efficient than the largest company and can potentially lift the total productivity up. Moving to the third period the less efficient company has exited the market, which is marked in the figure with an arrow. Simultaneously the new, more productive company has grown, due to more efficient use of resources and drawn labor from the previous market leader which respectively has grown smaller. As seen in the figure, the fourth period is the last one where the original market leader is in the still in the economy, but its size has drastically diminished from its original size.

In other hand, the company which entered the market in the second period has grown even further and the economy's total productivity has leaped to a higher level. In the last period the economy is as in the original state with one company, but the total productivity has rising to permanently higher level. The difference between the situation where there would not be any new entries or exits to the situation described above, is shown in the figure in the notion 2. If the entries and exits would face significant friction or totally blocked the economy's total productivity would be on a lower level 1.

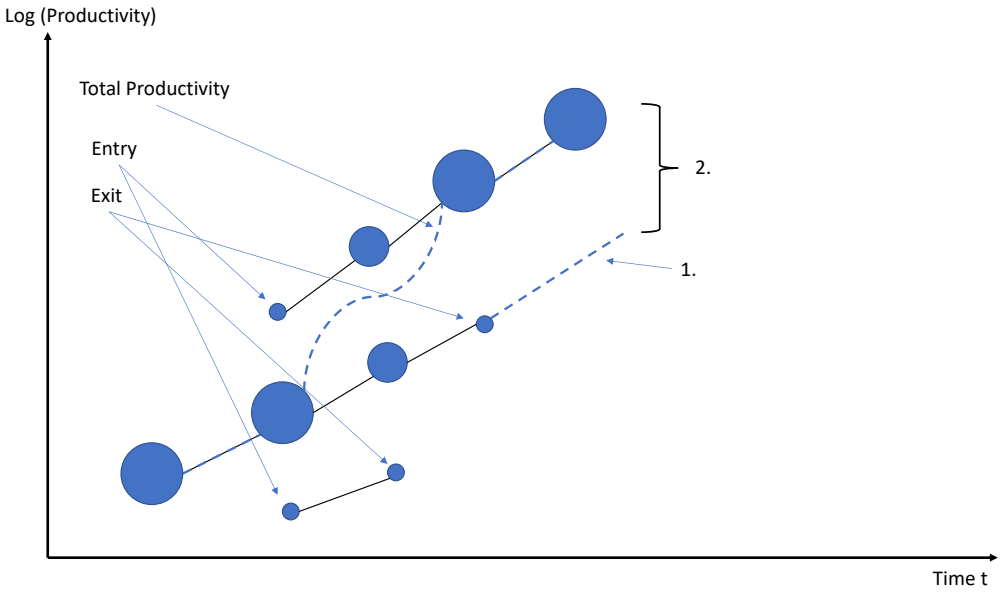

Figure 10 The mechanism of creative destruction (Maliranta, 2020)

The difference between the situation without entries and exit to a situation where the markets are working frictionlessly is one of the most severe violations that zombie companies cause to the economy and is proven empirically (Adalet McGowan et al., 2017; Andres & Petroulakis, 2019). As seen in figure 10 that is adapted from Maliranta (2020) the mechanism of functioning exits, and entries are crucial to the development of the economy's total productivity and thereby economic growth. Zombie companies that are not exiting the market and causing distortion to capital allocation are directly violating the mechanism of creative destruction which Aghion and Howitt (2009) present to be the driver of growth in developed countries.

Creative destruction affects the economy through three distinct channels: through new entries and exits and the level of productivity of the new companies compared to the companies that were in the economy in the previous period. Without the mechanism, as seen from figure 10., the economy cannot achieve the potential growth and not optimize the use of scarce resources.

Zombie companies are directly hindering the new companies from entering the markets and old, low efficient companies from exiting, harming the economy.

As argued above according to the endogenous innovation-based growth theories the source of growth in developed economies is innovations. By building limitations to frictionless entries and exits and by not developing more efficient institutions that could allocate resources more efficiently and identify zombie companies earlier many developed economies are causing severe harm to themselves as argued in the earlier chapter.

Albeit it is important to acknowledge that many policies that authorities have been forced to implement, as NIRP, and institutions that are built had to be done in a short time span and thorough research was not available at the time. Many of the policies have had a positive impact on the economy, but it is still important to scrutinize the side-effects to better understand what can be done better and trying fully to understand what kind of impact the polices have had on the economy and the magnitude of zombification of the economy. In the next chapter, this paper will present estimates of the magnitude of zombie companies in the Finnish economy utilizing listed company data.

7 Evidence from Finland

In this chapter of this paper, this paper will implement two broad estimates to the Finnish data sample for the last three consecutive years (2017-2019) to scrutinize the presence of zombie companies in the Finnish economy. The two methods used in this chapter are from the respected papers by Adalet McGowan et al. (2017) and further Banerjee and Hofmann (2018). The second estimate is in line with the model by Andrew and Petroulakis (2019) and Storz et al. (2017). By implementing two estimates, it is possible to get a wider perspective of the phenomena. However, it is important to acknowledge that the estimates used in this paper are broad, and more sophisticated models with broader data samples could further scrutinize the phenomena. This, however, is left in this paper for further research.

7.1 Estimating zombie companies in the Finnish economy

The data sample consists of Finnish companies whose shares have been listed in the OMXH25 and OMXHPI indexes. After controlling for duplicates and removing the companies which data could not be utilized for the estimates due to lacking information or not being active under the reference period, the number of companies in the dataset for the first estimate (Adalet McGowan et al., 2017; Banerjee & Hofmann, 2018) is 145. For the second estimate, the data sample is slightly larger, and the sample increases from 145 to 163. The reason for the larger dataset is in the different methods for estimating zombie companies and different business indicators which were not available for all companies.

The first estimate used in this paper scrutinizes if the Interest Coverage Ratio (henceforth ICR) for the last three consecutive years has been under one and if the company is over 10 years old. Younger companies can in nature have greater ICR ratios so therefore they are not considered as zombies by this estimate.

$$ICR = \frac{Earnings\ before\ interest\ and\ taxation\ (EBIT)}{Interest\ paid} \quad (9)$$

This measure tells how efficiently the company can pay its interest expenditures and if the ratio is under one for a prolonged period, it can be argued that the company's debt-paying capability is not ideal. The higher the ratio is, the better and investors use ICR to estimate the risk of capital lending to the company in question.

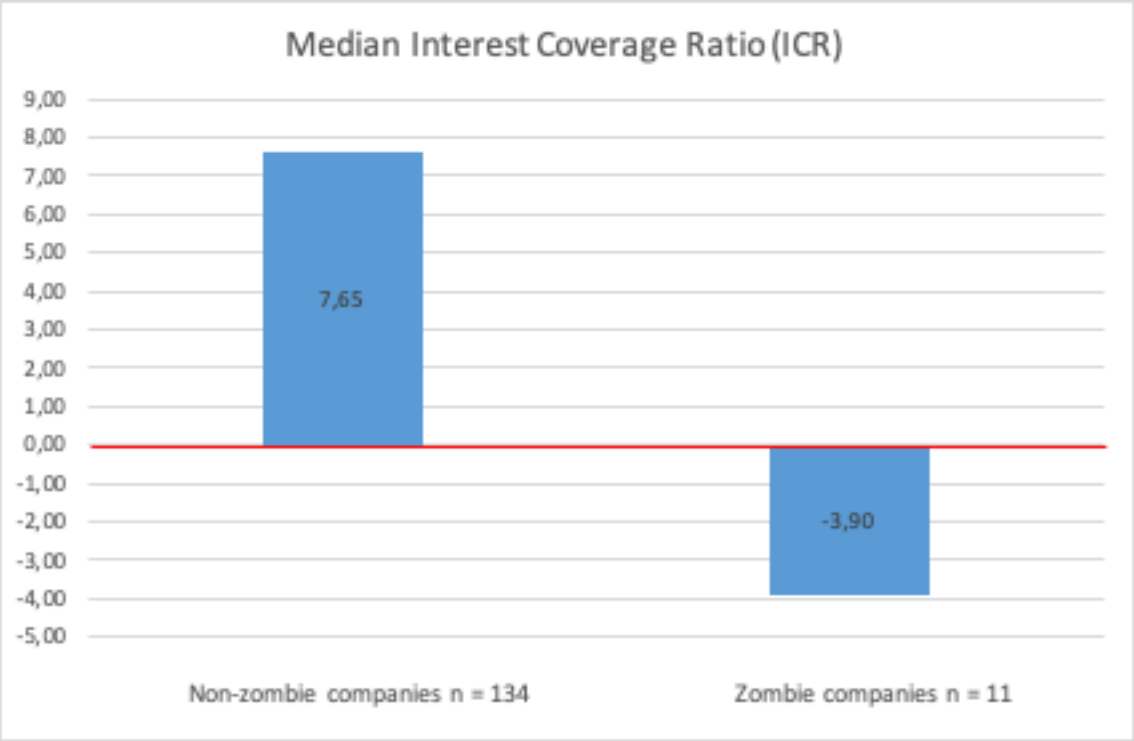

Figure 11 Median ICR 2017-2019

The results from the first estimate can be seen in figure 11., where companies classified as non-zombies are presented on the left and zombie companies on the right. Due to the heterogeneity of the data sample, the median values are presented in the figure, but more detailed results can be found from table 5. below.

As Adelet McGowan et al. (2017) and further Banerjee and Hofmann (2018) present in their article, companies with ICR-ratios below one for three consecutive years and where the company is at least 10 years old (Banerjee & Hofmann, 2018, p. 69) can be defined as a zombie company. The data sample used in this paper indicates that 11 companies of the 145 publicly traded companies in the Finnish economy can be defined according to the broad definition as a zombie.

Table 5 Quartile ICR data 2017-2019.

Quartile	**Non-zombie companies**	**Zombie companies**
Minimun value	-741,57	-77,04
First quartile (25th percentile)	1,52	-5,04
Median value (50th percentile)	7,65	-3,9
Third quartile (75th percentile)	27,83	-1,96
Maximum value	1623,56	-0,94

Interestingly, the Quartile ICR data -table presents a significantly lower minimum ICR-figure for non-zombie companies, but the unusually low observation derivates from a single company's value from a single year. Compared to the first estimate which is in line with Adalet McGowan et al. (2017) and Banerjee and Hofmann (2018), the second estimate utilizes different financial ratios compared to the first model. The second method estimates define zombie companies as companies whose earnings before interest and taxes to financial debt is under 20% for three consecutive years (Storz et al., 2017; Andrews & Petroulakis, 2019) is in line with Banerjee and Hoffmann (2018).

$$Debt\ service\ capability = \frac{Earnings\ before\ interest\ and\ taxes\ (EBIT)}{Financial\ Debt} \quad (10)$$

However, because of the nature of industries such as financial services that have in nature large financial debt ratios they are not classified as zombies in these estimates. Even though they would be classified according to this estimate as zombie companies, they are not considered such due to the nature of the industry.

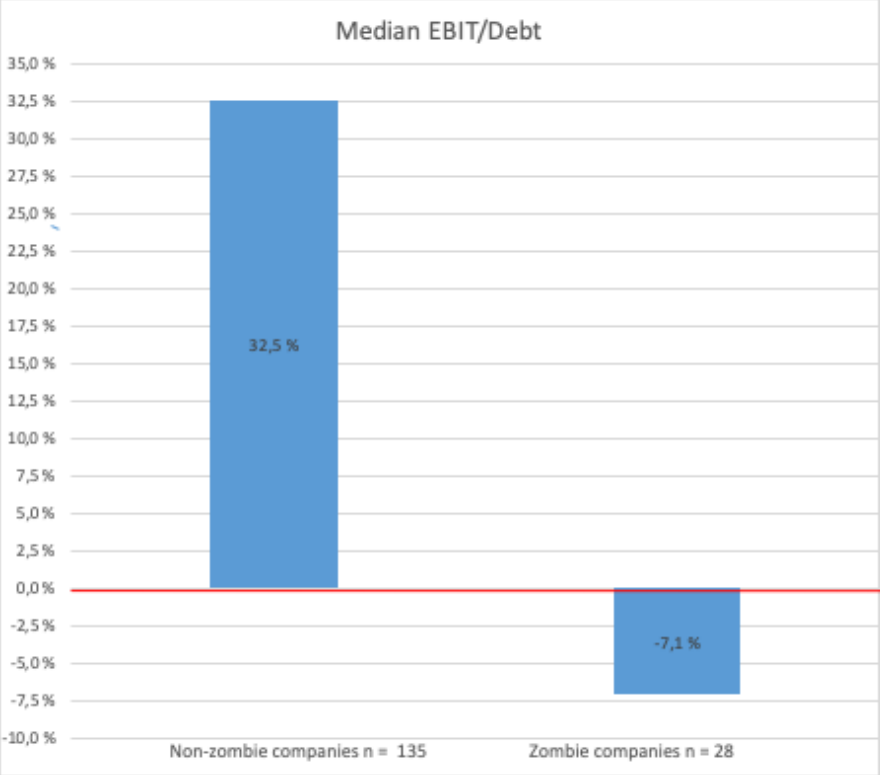

Figure 12 Median EBIT to Debt 2017-2019

The result of the second estimate is presented in figure 12., in line with the first estimate, where non-zombie companies are on the left side and zombie companies on the right. In this estimate, the number of observations, n=163, is larger than in the first one, due to the factor that the data sample had fewer missing values for EBIT and debt ratios compared to interest expenditure ratios used in the previous estimate. The median values are displayed in the figure and more detailed results can be found in table 6. below.

Table 6 Quartile EBIT to Debt ratio 2017-2019.

Quartile	**Non-zombie companies**	**Zombie companies**
Minimun value	-752 %	-290 %
First quartile (25th percentile)	15 %	-24 %
Median value (50th percentile)	32 %	-7 %
Third quartile (75th percentile)	339 %	7 %
Maximum value	21183 %	17 %

Even though the median EBIT to debt ratio is lower in the zombie companies group the lower minimum value is found within the non-zombie companies. However, this is observation is from a young firm, and as Andrews and Petroulakis argue in their article that they "*only consider firms aged ten years or more, as start-ups are in general not expected to be profitable"* (2019, p.16). Hence the outlier in the data sample is in line with the previous research and empirical estimates.

In line with Andrews and Petroulakis (2019) and Storz et al. (2017) and as a complimentary estimate to the EBIT to debt ratio, this paper scrutinizes return on assets (henceforth ROA) and return on investment capital (henceforth ROIC) ratios to determine the presence of zombie companies. As well as in the previously presented estimates, a company is considered as a zombie if it has negative ROA or negative ROIC ratios three consecutive years in a row. The results for the complimentary ROA and ROIC estimates can be seen from the table 7. below.

Table 7 ROA and ROIC estimate results.

	Return on assets (ROA)		Return on invested capital (ROIC)	
Quartile	**Non-zombie companies**	**Zombie companies**	**Non-zombie companies**	**Zombie companies**
Minimun value	-151,9	-77,9	-343,7	-105,3
First quartile (25th percentile)	1,1	-20,1	1,9	-27,0
Median value (50th percentile)	4,9	-5,9	6,5	-6,6
Third quartile (75th percentile)	8,3	-3,1	11,7	-4,6
Maximum value	73,3	-2,5	42,6	-3,2
Number of observation	**142**	**12**	**144**	**12**

The notion that lower ROA and ROIC ratios indicate that a company can be defined as a zombie if the situation is prolonged derivates from Andrew and Petroulakis (2019). They present that lower ROA and ROIC ratios hint that a company is in danger of exiting the market if its creditors do not agree on new terms. Furthermore, the ratio, which Andrews and Petroulakis (2019) define as NRI, correlates strongly with interest coverage measures with approximately 0.7 correlation. The difference between the number of observations in each group is due to the previously mentioned reason, for some companies it was unable to find all the ratios for the sample period 2017-2019.

The two broad estimates and the third additional ROA/ROIC estimate presented in table 7. provide a hint of the magnitude of zombie companies within the listed companies in Finland. However, the estimates used in this paper a broad and should be considered with caution. Caballero et al. (2008) present that by solely relying on financial ratios to identify zombie companies many industries would be in danger to be classified as zombies. This is due to the industry-specific characteristics and is the reason why financial industry companies are excluded from the zombie companies in this paper even though the ratios would say otherwise as argued earlier. Nonetheless, they provide an interesting insight into the phenomena to an economy that has in many cases been ignored in respected studies.

7.2 Vulnerable industries

As the seen in the previous chapter the two broad estimates, first by Adalet McGowan et al. (2017) and Banerjee and Hofmann (2018) and second by Storz et al. (2017) and Andrew and Petroulakis (2019), utilizing Finnish data sample present evidence of the zombie company phenomena in the Finnish economy. Even though the estimates provide an insight into the magnitude of non-efficient companies it is important to further scrutinize the characteristics of these said companies to better understand if zombification is more prominent in some industries than others. In table 8. below the results of the estimated zombie companies are grouped by industries.

Table 8 Number of zombie companies within industries.

Industry	IRC	EBIT/DEBT	ROA	ROIC
Alternative Energy	1	1	1	1
Chemicals	-	1	-	-
Construction and Materials	-	2	-	-
Electronic and Electrical Equipment	1	1	-	-
Fixed Line Telecommunications	-	1	-	-
Food Producers	1	1	2	2
General Industrials	1	1	1	1
General Retailers	1	2	1	1
Household Goods and Home Construction	-	1	1	1
Industrial Transportation	-	1	-	-
Leisure Goods	-	1	-	-
Mining	2	2	2	2
Pharmaceuticals and Biotechnology	-	1	-	-
Software and Computer Services	2	7	2	2
Technology Hardware and Equipment	-	1	-	-
Travel and Leisure	-	1	-	-
Unknown	2	3	2	2
Number of observations	**11**	**28**	**12**	**12**

Even though the data sample is constrained by the small size of the Finnish economy and the number of listed companies, it can quickly be seen that few industries are more prominent than others when evaluating the presence of zombie companies.

For example, mining companies are classified as zombie companies by all four estimates in the same sense as software and computer services. The same pattern is seen in almost every industry and appears that EBIT to debt ratio is especially sensitive classifying companies as zombies (n=28). As described in the previous chapter, the EBIT to debt ratio is problematic due to the reason it misclassified easily companies as zombies, even though greater debt ratios can be a characteristic of the industry where they are operating in (Caballero et al., 2018). An example of this is the financial industry, which in the data sample systematically presented low EBIT to debt ratios, but due to their industry, classification of these companies as zombie companies would have been flawed.

As these estimates have shown it can be argued that to a extend level that there is a presence of zombie companies in the Finnish economy within the listed companies. However, the used estimates are broad and in line with Banerjee and Hofmann (2018) and Caballero et al. (2018) more sophisticated estimates could possibly give a better insight to the magnitude of the phenomena. In particular, including small- and medium-sized enterprises (SME) that are not listed in the data sample would give the possibility to scrutinize the impact of creditors' willingness of implementing lower interest rates on loans. However, that is left for future research.

7.4. Key limitations

The key limitations of this paper concern the global COVID-19 pandemic that has defined the year 2020. It has forced policymakers and central bankers to implement significant stimulus packages in short time spans underlining the importance of efficient capital allocation. This has raised increasing concern regarding the capital allocation channel and efficient monitoring of the recipient’s bot in Finland and globally.

This paper focuses on the events occurring before the pandemic and hence the used data does not reflect the impact of the implemented measures and policies.

The pandemic was a shock which no one could have predicted, and it imposes a limitation of this paper and the results. However, due to the rapidly evolving nature of the pandemic researches regarding the impact of COVID-19 has been scarce and with more time it is possible the estimate the efficiency of the newly implemented stimulus packages and capital allocation.

8 Conclusion

This paper aims to estimate the zombie companies' presence in the Finnish economy utilizing listed company data and scrutinize the negative side-effects of zombie companies. Although utilizing a wide range of ordinal monetary policies, the ECB has not reached the targeted sub 2% inflation level and has been pushed to seek answers from new tools. These tools, NIRP in particular, have had a positive effect on the economy but simultaneously brought new problems to the economy, which critics have been arguing to cause more harm than good. In the front of these problems have been the increasing number of zombie companies that according to endogenous innovation-based growth theories, should exit the markets. However, due to the low-interest rate and inefficient capital allocation channel, they hinder economic growth and cause the most harm to new entries by building bottlenecks.

When utilizing broad estimates to listed company data from the Finnish economy, zombie companies' presence can be proven. Estimate, in line with Adalet McGowan et al. (2017) and Banerjee and Hofmann (2018), indicates that 25% of the companies from the data sample (n=44) can be defined as zombies and were most prominent in the mining and software and computer services industries. Compared to the estimates by Banerjee and Hofmann (2018) where the share of zombie companies by the broad estimate is 12% in 2008, the share is larger. Estimate, which utilized EBIT to debt ratio commensurate with Storz et al. (2017) and further Andrews and Petroulakis (2019), implies that 17% of the companies signify being zombies from the larger data sample (n=163). According to the estimate, the zombie companies were most prominent in the software and computer services industry, which was also the result of the first estimate. However, contrary to the results financial institutions were not defined as zombies even though the estimated ratios would have categorized them as such companies, which is in line with Caballero et al. (2018).

For future research, the impact of the year defining COVID-19 pandemic provides interesting research opportunities.

In particular, estimating the volume of market exits which derive from the pandemic separate from the natural market exit is an interesting research subject. Further, the large stimulus packages can have a positive impact on the share of zombie companies if the screening is not done efficiently and the capital allocation channel is not functioning. Albeit COVID-19 has been harmful to the economies, it provides interesting opportunities for future research regarding zombie companies and their effect on the economy. Especially, in the challenging situation, the large stimulus packages and their effect on the economy present an interesting path for future research.

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10 Appendix

1. Dell'Ariccia etal. summary of nonconventional monetary policy academic papers (p. 158-159, 2018)

Unconventional Monetary Policy Effects in the Euro Area

Study	*Notes*	*Goverment bond yields*	*Real GDP*	*Prices*	*Other*
Darracq-Paries and De Santis (2015)	3-year LTRO effects using a VAR mode		+0.8%	+0.3%	+3% credit, -0.2% lending spreads
Cahn, Matheron and Sahuc (2014)	Effects of an LTRO of 2% of GDP. DSGE model with financial frictions		1%		
De Pooter, Martin, and Pruitt (2015)	Effect of the SMP on peripheral bonds liquidity premia	−32 to −40 bps on impact, −13 to −17 bps are lasting			
Ghysels, Idier, Mangenelli, and Vergote (2016)	Effects of SMP with VAR model with highfrequency data.	−320 bps (Italy 2y), −180 bps (Spain 2y), −230 bps (Italy and Spain 10y). Similar results for Ireland and Portugal, not significant for Greece.			
Eser and Schwab (2016)	Cumulative SMP effects of purchases looking at high-frequency data	−10 bps (5y), −170 bps (Portugal .5y), −190 bps (Spain 5y), −210 bps (Italy 5y), −330 bps (Greece 5y)			
Ferrando, Popov, and Udell (2015)	OMT effects of SME access to credit in euro area distressed countries				Probability of being credit constrained was reduced by 6.4%
Altavilla, Giannone, and Lenz (2014)	Effects of OMT announcements using event studies and VAR models	−199 bps (Italy 2y) −234 bps (Spain 2y), no effects in Germany and France	+1.5% (Italy), +2% (Spain)	+1.2% (Italy), +0.74% (Spain)	+3.6% (credit, Italy), +2.3% (credit, Spain)

Fratszcher, Lo Duca, and Straub (2016)	Effects of LTRO, SMP, and OMT announcements using highfrequency data	−25 bps to −121 bps (Italy and Spain 10y)			+4.1 to +8.7% (equity prices)
Krishnamurthy, Nagel, and VissingJorgensen (2018)	Effects of OMT, SMP, and LTROs	−200 bps (Italy and Spain 2Y), −500 bps (Portugal and Ireland 2y), −1,000 bps (Greece 2y).			+4% to +13% (stock prices)
Koijen, Koulischer, Nguyen, and Yogo (2016)	Effects of APP on portfolio holdings by institutional investors	Average −13 bps. Range −2 to −60 bps (higher in distressed countries)			
Andrade, Breckenfelder, De Fiore, Karadi, and Tristani (2016)	Effects of APP using time series and DSGE models	−45 bps	+1.1%	+0.4% (actual), +0.45% (expectations)	
Mouabbi and Sahuc (2016)	Effects of APP and TLTRO using a DSGE model with an estimated shadow rate		+0.56% (average of 2014–2016)	+0.25% (average of 2014–2016)	-400 bps (shadow rate)
Cova, Pagano, and Pisani (2015)	Effects of APP in a DSGE model		+1.4%	+0.8%	
Hutchinson and Smets (2017)	Effects of NIRP, TLTRO, and APP	−155 bps (Average euro area 10y bond)	+1.7% (accum. 2016–2019)	+0.5% (accum. 2016–2019)	-70 bps (lending rate), 13 percent euro depreciation